ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE2 DIABETICS

A THESIS SUBMITTED TO THE BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT (PUNJAB)

FOR THE AWARD OF DEGREE OF

MD

IN

MEDICINE

BY

DR KAPIL DEV

SUPERVISOR

DR. DINESH GUPTA

DEPARTMENT OF MEDICINE
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA
(MAY, 2021)

DECLARATION

I declare that the thesis entitled **"ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE2 DIABETICS" has** been prepared by me under the guidance of **Dr. Dinesh Gupta**, Professor & Head, Department of Medicine, Dayanand Medical College and Hospital, Ludhiana. No part of this thesis has formed the basis for the award of any degree previously.

Dr. Kapil Dev
Department of Medicine
Dayanand Medical College & Hospital
Tagore Nagar
Ludhiana-141001
Punjab

Date:

CERTIFICATE

I certify that **Dr. Kapil Dev** has prepared his thesis entitled **"ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE2 DIABETICS"** for the award of degree of M.D. in Medicine of Baba Farid University of Health Sciences, under my guidance. He has carried out the work at the Department of Medicine, Dayanand Medical College & Hospital, Ludhiana.

Supervisor

Dr. Dinesh Gupta
Professor & Head
Department of Medicine
DMCH, Ludhiana

Co-Supervisor

Dr. Parminder Singh
Professor & Head
Department of Endocrinology
DMCH, Ludhiana

Dr.Gurpreet Singh Wander
Professor& Head
Department of Cardiology
DMCH, Ludhiana

Date:

ENDORSEMENT BY THE HEAD OF THE DEPARTMENT AND PRINCIPAL

This is to certify that the thesis entitled **"ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE2 DIABETICS"**is a bonafide research work done by **Dr. Kapil Dev** under the guidance of **Dr. Dinesh Gupta**, Professor& Head, Department of Medicine, Dayanand Medical College & Hospital, Ludhiana.

Head of Department

Dr. Dinesh Gupta
Professor & Head
Department of Medicine
DMCH, Ludhiana

Principal

Dr. Sandeep Puri
Principal
DMCH, Ludhiana

Date:

COPYRIGHT

Declaration by the Candidate

I hereby declare that the Baba Farid University of Health Sciences, Faridkot, shall have the rights to preserve, use and disseminate this thesis in print or electronic format for academic / research purpose.

Dr. Kapil Dev
Department of Medicine
Dayanand Medical College & Hospital
Tagore Nagar
Ludhiana-141001
Punjab

Date:

© Baba Farid University of Health Sciences,

Faridkot

Dedicated
To
My Family
&
Teachers

ACKNOWLEDGEMENT

I am highly grateful to the **Almighty** without whose blessings no work can be conceived, much less completed. His presence we feel at each and every step of life. He's the one who holds our hand and guides us through everything.

I take this opportunity to thank all those who have been helping me in the successful completion of this work.

With deep sense of gratitude, I wish to convey my thanks to my esteemed teacher and supervisor **Dr. Dinesh Gupta,** Professor and head, Department of Medicine, DMC&H, Ludhiana who has been most helpful and supportive throughout my tenure. His able and mature guidance, ever willing help made the assigned task simpler. He has always been an epitome of excellence for me.

It is with great reverence and profound pleasure that I acknowledge the valuable suggestions, scholarly guidance and constant encouragement rendered by my co-supervisor **Dr. Parminder Singh Professor**, Department of Endocrinology & **Dr. Gurpreet Singh Wander**, Professor, Department of cardiology, DMC&H, Ludhiana. An opportunity to learn from them has been one of special things that this work provided. I am really indebted to them for being so supportive throughout. I take great pride in expressing my gratitude to them.

Words are woefully inadequate to express my sense of gratitude to my parents **Mr. Madan Lal** & **Mrs. Amarvati**, for their love, selfless sacrifices, unfailing attention to my needs and blessings that have made me whatever I am today.

No words are enough to thank my Sister **Dr. Mamta sen, Mis Suman Sen ,Mis Shivani sen & my younger brother mrs.sunny sen & Shubham sen** and my Friend **Dr.Naina mehmi,**whose care, affection,

timely help and encouragement have been a constant source of inspiration throughout.

My thanks to colleagues & juniours **Dr. Shaminder singh dhillon**, **Dr.Rajwinder kaur dhaliwal** *,* ***Mrs kadir ali, dr.abhinav garg***

And my seniors ***Dr pawan kumar****,* ***Dr. Abhinav Meelu, Dr. Ashwini Chauhan, Dr Onkar Singh Matharoo ,Dr. Jasvinder Singh, Dr.Ravi krishna, Dr. Kritarh, Dr harpreet kaur, Dr sukhveer kaur*** *and all my juniors for their brilliant company in this journey****.*** *They have been an invaluable support day in, day out for the entire course of work.*

Thanks to all the patients who have been a part of this study and DMCH staff & residents who made this uphill task possible.

A Special Thanks to **Mr. Naveen Bhatia, Mrs. Sampada Sharma, & Mrs. Namita**, Research & Development centre for their efforts.

Dr. Kapil Dev…

ABBREVIATIONS

NCD	Non communicable disease
DM	Diabetes Mellitus
IDF	International diabetes federation
BMI	Body Mass Index
W/H RATIO	Waist Hip ratio
FBS	Fasting blood glucose
PPBS	Post-prandial blood sugar
HbA1c	Glycosylated haemoglobin A1c
LVEF	Left ventricular ejection fraction
GLP-1	Glucagon like peptide-1
cAMP	Cyclic AMP
HNF	Hepatocyte nuclear transcription factor
MODY	Maturity onset diabetes of young
ATP	Adenosine triphosphate
GDM	Gestational diabetes mellitus
ADA	American diabetes association
GAD	Glutamic acid carboxylase
IA-2/ICA-512	Tyrosine phosphatases
Zn T-8	Zinc transporter
AGE	Advanced glycosylated end products
ECG	Electrocardiogram
CAN	Cardiac autonomic neuropathy
PN	Peripheral neuropathy
IGT	Impaired glucose tolerance
PAS	Periodic acid Schiff
VLP	Ventricular late potentials
IDDM	Insulin dependent diabetes mellitus
NIDDM	Non-insulin dependent diabetes mellitus

ASD	Atrial septal defect
SBP	Systolic blood pressure
DBP	Diastolic blood pressure
AML	Atrial mitral leaflets
LVM	Left ventricular mass
LA	Left atrium
MV	Mitral valve
LV	Left ventricular
LA-D	Left atrium-dilated
LV-D	Left ventricular- dilated
LVH	Left ventricular hypertrophy
LVSD	Left ventricular systolic dysfunction
LVDD	Left ventricular diastolic dysfunction
LVOD	Left ventricular overall dysfunction
LVPWT	Left ventricular posterior wall thickness
LVID	Left ventricular internal diameter
EF	Ejection fraction
FS	Fractional shortening
EDV	End diastole volume
ESV	End systole volume
IVST	Interventricular septal thickness
RA	Right atrium
RVID	Right ventricular internal diameter
RWMA	Regional wall motion abnormalities
GHK	Global hypokinesia
SD	Systolic dysfunction
DD	Diastolic dysfunction
OD	Overall dysfunction

ABSTRACT

Introduction: Worldwide, there are more than 463 million adult cases of type 2 diabetes and this number is expected to double by 2045. India is home to 77 million diabetics, second highest in the world and this number is expected to cross 100millionin 2030.

Objectives: to study the pattern of echocardiographic findings and to correlates the findings in long standing DM , to measure the relation of LV systolic and diastolic dysfunction with age , duration of diabetes, Hba1c, obesity indices .

Methods: This was an observational prospective study conducted at Dayanand Medical College and Hospital, Ludhiana, Punjab, India between 2018 and 2020. subjects were 300 DM patients who either came for regular health check-up. The informed consent was obtained from the participants after explaining them about study In their first language, Punjabi or Hindi.

Results: Majority of patients belonged to age group 51-60 years (n=126, 42.0%). Out of total 300 patients, 206 (68.7%) were males and 94 (31.3%) were female, Interventricular septal thickness was high in both the group (systolic{68.7%} and diastolic{51.3%}). Left ventricular diameter was high in both the group (systolic {19.3%} and diastole{9%}).left ventricular posterior wall thickness was high in both systolic(74.7%) and diastolic group(46%). Global hypokinesia was seen in 5.3 % patients .23& showed regional wall motion abnormalities. Left ventricular hypertrophy was seen in 36.3% patients. The study showed that 82(27.3%) patients had systolic dysfunction, 84(28.1%) patients had diastolic dysfunction, and 140 (46.7%) patients had both systolic and diastolic dysfunction. Based on multivariate Analysis, the parameters such as age, BMI, LVH, FBS were statically significant (p-value <0.05)

Conclusion: Patients with Type 2 DM should be screened for subclinical LVDD by echocardiography regardless of cardiac symptoms and clinical characteristics. Diastolic Dysfunction in diabetic patients is independent of duration of diabetes .Early diagnosis and institution of treatment with ACE inhibitors, angiotensin II receptor blockers, aldosterone antagonists, and diuretics will reduce the morbidity and improve the outcome of diastolic heart failure.

Keywords: Diabetes Mellitus, diastolic dysfunction, *echocardiography, LA size*

TABLE OF CONTENTS

S. NO.	TOPIC	PAGES
I	INTRODUCTION	1-3
II	AIMS AND OBJECTIVES	4
III	REVIEW OF LITERATURE	5-34
IV	MATERIAL AND METHODS	35-40
V	OBSERVATIONS AND RESULTS	41-69
VI	DISCUSSION	70-75
VII	SUMMARY AND CONCLUSION	76-77
VIII	BIBLIOGRAPHY	78-92
	APPENDICES – I - PROFORMA - MASTER CHART	
	APPENDICES – II - APPROVAL LETTER OF THESIS PLAN - THESIS PLAN	

LIST OF TABLES

Table No.	Title	Page No.
1	ETIOLOGIC CLASSIFICATION OF DM	7
2	Varies Studies	13
3	INCIDENCE OF VARIOUS COMPLICATION OF TYPE 2 DM	16
4	Distribution of Cases According to Sex	41
5	Distribution of Patients According to Age	42
6	Distribution of Cases According to BMI	43
7	Past History of Cases Enrolled	44
8	Distribution of Cases According to Duration of Diabetes	45
9	Nature of Lifestyle of the Patients	46
10	Aortic Root Group	47
11	Left Atrium Group	48
12	Right Atrium Group	48
13	Right Ventricular Internal Diameter (RVID) Group	49
14	Interventricular Septal Thickness (IVST) – Diastole Group	50
15	Interventricular Septal Thickness (IVST) – Systole Group	50
16	Left Ventricular Internal Diameter (LVID) - Diastole Group	51
17	Left Ventricular Internal Diameter (LVID) - Systole Group	51
18	Left Ventricular Posterior Wall (LVPWT) – Diastole Group	52
19	Left Ventricular Posterior Wall (LVPWT) - Systole Group	52
20	Wall Motion Abnormalities in Study Group	53

21	. Cardiac Chambers	54
22	Systolic Dysfunction	55
23	Diastolic Dysfunction	55
24	Overall Dysfunction Group	55
25	Intergroup Data Extrapolation	56
26	Echocardiographic Parameters	63
27	Multivariate Analysis (LVDD group)	69
28	Multivariate Analysis(LVSD group)	69

LIST OF FIGURES

Fig. No.	Title	Page No.
1	Global Fact Sheet for Type 2 DM Patients	6
2	DM and HF	13
3	Schematic illustration of Diabetic Cardiomyopathy	15
4	Distribution of Cases According to Gender	41
5	Distribution of Cases Based on Age	42
6	Number of Cases Based on BMI	43
7	Past Medical History of Cases With Diabetes	44
8	Case Distribution According to Duration of Diabetes	45
9	Lifestyle of the Patients	46
10	Aortic Root Dimensions	47
11	Size of LA	48
12	Size of RA	48
13	RVID	49
14	Interventricular Septal Thickness (IVST)	50
15	LV Internal Diameter (LVID)	51
16	LV Posterior Wall Thickness	52
17	Wall Motion Changes	53
18	Change in Cardiac Chambers	54
19	Systolic Dysfunction	56
20	Diastolic Dysfunction	56

Fig. No.	Title	Page No.
21	Both (Systolic and Diastolic Dysfunction)	56
22	Age	58
23	Duration	59
24	DBP	59
25	SBP	60
26	Pulse	60
27	BMI	61
28	Waist Hip Ratio	61
29	FBS	62
30	HbA1c	62
31	RVID (D)	65
32	Aortic Root, Left Atrium, Right Atrium	65
33	IVST	66
34	LVID	66
35	LVPW	67
36	LVEF, FS	67
37	EDV, ESV	68
38	MV-E, MV-A, AV	68

INTRODUCTION

In the present era of antibiotics, the incidence and prevalence of infectious diseases are declining. On the other hand, chronic diseases such as diabetes are on the rise resulting in an increased negative impact on the quality of life. These diseases have also increased the economic burden for the population seeking care and healthcare system [1].

The mortality rate associated with chronic diseases is about 36 million deaths per year globally [2]. A study conducted in the USA shows that non-communicable diseases (NCD) account for 94.7 trillion dollar expenditure [3]. According to the WHO predictions, NCDs will be responsible for 70% of the deaths worldwide by 2025, and 85% of these deaths will occur in the developing countries [2]. For the past few decades, extensive research is being conducted on these diseases resulting in flooding of the literature. Also, extensive measures are being adopted for monitoring purposes.

One of the chronic diseases is known as Diabetes Mellitus (DM), which is known to mankind for ages. The prevalence of DM has gone up dramatically over the past two decades, from an estimated 108 million cases in 1980 to 463 million in 2019. Based on current trends, the International Diabetes Federation (IDF) projects approximately 700 million people with diabetes by the year 2045. In 2015, the incidence and prevalence figures of diabetes were highest in China, followed by India in second place [4]. Diabetes and cardiovascular diseases are becoming pandemic in the Southeast Asian Subcontinent, with India in the lead with the most numbers [6]. Indians are more prone to diabetes compared to other races. Another important factor contributing to Type 2 diabetes in Asian is that an Indian has a greater degree of insulin resistance compared to Caucasians [7,8].

Diabetes Mellitus is broadly classified into Type 1 (T1) and Type 2 (T2) based on the pathogenic characteristics of total insulin deficiency and insulin resistance. The factors such as uncontrolled diabetes and advanced age play a significant role in the pathogenesis

of atherosclerosis, which refers to the deposition of oxidized cholesterol into the walls of blood vessels [5]. Therefore, this results in occlusion and stiffness of the major blood vessels leading to vital organ dysfunction, namely heart, kidney, or brain.

According to the American Heart Association, DM is a controllable risk factor for cardiovascular diseases. The risk of cardiovascular diseases is lower in the youth with a brief duration of Type 2 DM compared to the older population [9]. Cardiovascular complications of diabetes cause morbidity and mortality in diabetic patients. Cardiovascular complications include ischemic heart disease and cardiomyopathy, which may lead to heart failure. This is very harmful to the patients since there is no clinical manifestation of the initial stage of heart failure, left ventricular diastolic dysfunction owing to diabetes. In other words, silent ischemia is common in diabetic patients, so it is important to conduct a cardiac evaluation to rule out any uncertainty in the status of the heart, like biochemical, electrical and mechanical dysfunction. This can be done by assessing diabetic control, ischemia and heart failure markers, electrocardiography, and echocardiography[11,12]. The elevated HbA1c predicts risk of diabetes in asymptomatic individuals and also predicts other risks like coronary heart disease and stroke[10].

Echocardiography is an assessment tool that uses high frequency sound waves to produce live images of the heart. Thus, it assesses mechanical functions such as systolic function, diastolic function, ejection fraction or the percentage of blood ejected with each beat. The systolic function is calculated by subtracting end-systolic volume from end-diastolic volume and dividing by end-diastolic volume. The Left Ventricular Ejection Fraction (LVEF) is normal when its >50% or greater [13].

The restrictive physiology and severe diastolic dysfunction can be depicted with a short duration (<150ms) of mitral deceleration. Also, mitral annular relaxation velocity (E') is inversely related to the time constant of relaxation, so E/E' directly correlates with left ventricular filling pressure (E is mitral inflow maximal velocity), and it is a

significant prognostic factor. Other assessment tools for the diastolic function that takes many diastolic parameters into consideration include doppler tissue based relaxation velocities, pulmonary venous doppler and left atrial size [13].

Even though there have been a vast amount of studies conducted on heart dysfunction in patients with diabetes, there are many gaps such as the correlation of body mass index and duration of diabetes associated with heart dysfunction in diabetics. The present study has been conducted to determine the patterns of echocardiographic findings in long-standing diabetes and to look for any correlation of age, duration of DM, glycosylated hemoglobin A1c (Hb A1C), obesity indices with systolic and diastolic parameters.

AIMS & OBJECTIVES

1. To determine the pattern of echocardiography findings and to correlates the findings in long-standing diabetes mellitus.
2. To measure the relation of LV systolic and diastolic dysfunctions with age, duration of DM, HbA1c, obesity indices, and microvascular complications of diabetes

REVIEW OF LITERATURE

Diabetes Mellitus is a common metabolic disorder characterized by excess glucose in the blood with a relatively deficient state intracellular. It is derived from the Greek word “diabetes” which means siphon – to passer through, and “mellitus” means honeyed or sweet. Thus, the full meaning of the word, diabetes mellitus is an excessive amount of sweet urine produced, eliminated, and attracted the ants due to its sweet nature[14]. In addition, this disease is often mentioned in ancient Chinese and Egyptian literature. In Indian Vedic literature, diabetes mellitus is described as Madhumeha, which means excretion of sugar with urine due to the body’s inability to control the sugar levels in the blood [15].

The symptoms of diabetes mellitus range from mild, like thirst, polyuria, and weight loss, to severe, which includes ketoacidosis or a non-ketotic coma. An asymptomatic period of hyperglycemia is common in Type 2 DM. People with diabetes are at increased risk of cardiovascular, peripheral vascular and cerebrovascular diseases, as mentioned before [16,17].

EPIDEMIOLOGY AND GLOBAL CONSIDERATIONS

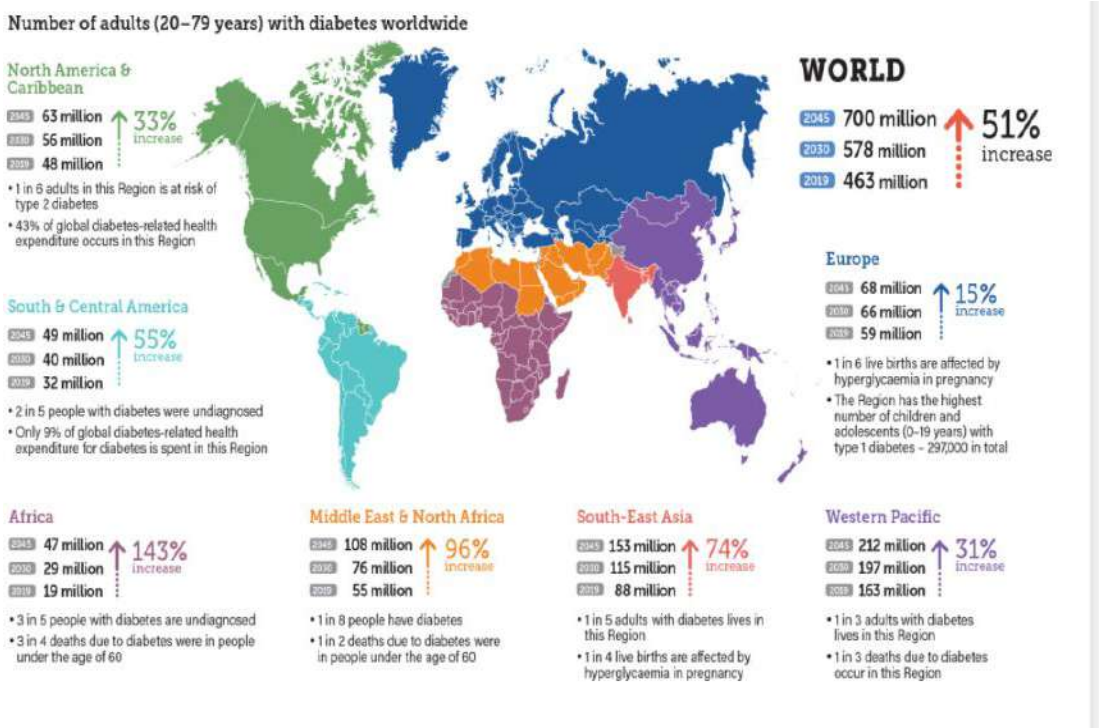
In present times, diabetes has become a significant public health burden worldwide. The prevalence of diabetes has roared-up from 300 million cases in 1985 to 382 million in 2013 globally. The numbers are forecasted to increase further to 552 million by the year 2030[18]. This majority of rising is occurring in the developing countries at around 69% [19].

In 2019, a Global survey was conducted by the International Diabetes Federation suggested approximately 463 million adults between the ages of 20-79 years were diagnosed with diabetes, and it is estimated to rise to 700 million by 2045. The proportion of people with Type 2 DM is going up in most countries, and 79% of these people are living in low and middle-income countries. In the population aged 65 years and

above, 1 in 5 individuals have diabetes, and 1 in 2 (232 million) diabetic patients were not diagnosed.

Diabetes mellitus has caused more than 4.2 million deaths. The spending on diabetes was at least 760 billion dollars in 2019, with 10% of this was particularly on adults [4]. Currently, the umber of diabetes diagnosed cases is 77 million, and this number is expected to double by 2045. India has the largest number of diabetic patients resulting in India as the "***Diabetes Capital of the World***" [20].

Figure 1. Global Fact Sheet for Type 2 DM Patients


Number of adults (20–79 years) with diabetes worldwide
North America & Caribbean
2045 63 million
2030 56 million
2019 48 million
33% increase
• 1 in 6 adults in this Region is at risk of type 2 diabetes
• 43% of global diabetes-related health expenditure occurs in this Region
South & Central America
2045 49 million
2030 40 million
2019 32 million
55% increase
• 2 in 5 people with diabetes were undiagnosed
• Only 9% of global diabetes-related health expenditure for diabetes is spent in this Region
WORLD
2045 700 million
2030 578 million
2019 463 million
51% increase
Europe
2045 68 million
2030 66 million
2019 59 million
15% increase
• 1 in 6 live births are affected by hyperglycaemia in pregnancy
• The Region has the highest number of children and adolescents (0–19 years) with type 1 diabetes – 297,000 in total
Africa
2045 47 million
2030 29 million
2019 19 million
143% increase
• 3 in 5 people with diabetes are undiagnosed
• 3 in 4 deaths due to diabetes were in people under the age of 60
Middle East & North Africa
2045 108 million
2030 76 million
2019 55 million
96% increase
• 1 in 8 people have diabetes
• 1 in 2 deaths due to diabetes were in people under the age of 60
South-East Asia
2045 153 million
2030 115 million
2019 88 million
74% increase
• 1 in 5 adults with diabetes lives in this Region
• 1 in 4 live births are affected by hyperglycaemia in pregnancy
Western Pacific
2045 212 million
2030 197 million
2019 163 million
31% increase
• 1 in 3 adults with diabetes lives in this Region
• 1 in 3 deaths due to diabetes occur in this Region

REGULATION OF GLUCOSE HOMEOSTASIS

Glucose homeostasis is a result of complex interactions between gluconeogenesis in the liver and muscles and glucose utilization by the cells in the body. Insulin is the most significant regulator of the metabolic equilibrium. However, factors like neural input, metabolic signals, and other hormones (glucagon) play an important role in the integrated control of glucose supply and utilization [21].

ROLE OF INSULIN

Insulin is produced from beta cells of the pancreases and secreted in a pulsatile pattern due to hormonal influence of incretins, insulinotropic peptides such as glucagon-like-peptide-1 (GLP-1), and glucose dependant insulinotropic peptide via formation of the cyclic-AMP when the blood glucose level is above the fasting level. The incretins hormones also suppress the production and secretion of glucagon, which increases the glucose levels in the blood.

The secreted insulin enters the circulation system and binds to its receptors. This causes a complex cascade of phosphorylation and dephosphorylation reactions, which result in its metabolic and mitogenic effects based on the pathogenic process leading to hyperglycemia. In recent studies, there is increasing recognition of other forms of diabetes based upon molecular pathogenesis.

TABLE 1: ETIOLOGIC CLASSIFICATION OF DM

I. Type 1 DM	Immune-mediated beta cell destruction, usually leading to absolute insulin deficiency.
II. Type 2 DM	Ranges from predominantly insulin resistance with relative insulin deficiency to a predominantly insulin secretory defect with insulin resistance.
III. Specific Types of DM	**A. Genetic defects** of beta-cell development/ function characterized by mutation in: 1. Hepatocyte nuclear transcription factors (HNF) 4α (MODY 1) 2. Glucokinase (MODY 2) 3. HNF - 1α (MODY 3) 4. Insulin promoter factor-1, HNF-1β, NeuroD1, others leading to other forms of MODY 5. Insulin, subunit of ATP-sensitive potassium channel leading to permanent neonatal diabetes 6. Mitochondrial DNA

	7. Other pancreatic islet regulators/proteins such as KLF11, PAX4, BLK, GATA4, GATA6, SLC2A2 (GLUT2), RFX6, GLIS3
	B. Transient neonatal Diabetes
	C. Diseases of the exocrine pancreas:- pancreatitis, pancreatectomy, neoplasia, cystic fibrosis, hemochromatosis, fibrocalculous pancreatopathy, mutations in carboxy ester lipase **D. Genetic defects in insulin action**, including type A insulin resistance, Leprechauism, Rabson-Mendenhall syndrome, Lipodystrophy syndrome **E. Endocrinopathies:-** acromegaly, cushing syndrome, glucagonoma, phochromocytoma, hyperthyroidism, somatostatinoma, aldosteronoma **F. Drug or Chemical-induced**:- glucocorticoids, vacor (rodenticide), pentamidine, nicotinic acid, diazoxide, β-adrenergic agonists, thiazides, calcineurin and mTOR inhibitors, hydantoins, asparaginase, α-interferon, protease inhibitors, antipsychotics (atypical and others), epinephrine **G. Infections**—congenital rubella, cytomegalovirus, coxsackievirus **H. Uncommon forms of immune-mediated diabetes**- Stiff-person syndrome, anti-insulin receptor antibodies **I. Other genetic syndromes** that are rarely associated with diabetes— Wolfram's syndrome, Down's syndrome, Klinefelter's syndrome, Turner's syndrome, Friedreich's

	ataxia, Huntington's chorea, Laurence-Moon-Biedl syndrome, myotonic dystrophy, porphyria, Prader-Willi syndrome
IV. Gestational DM (GDM)	

CRITERIA FOR DM

International expert committee constituting members from the American Diabetes Association (ADA), the European Association for the Study for Diabetes, and the International Diabetic Federation (IDF) have developed criteria for the diagnosis of DM. WHO criteria for the Diagnosis of DM is as follows.

- Symptoms of DM + Random Blood Glucose Concentration ≥11.1 mmol/L (200mg/dL)
- Fasting Plasma Glucose ≥ 7.0 mmol/L (126mg/dL)
- Haemoglobin A1C ≥ 6.5%
- 2-hour plasma glucose ≥11.1 mmol/L (200 mg/dL) during an oral glucose tolerance test
- Point of care – Haemoglobin A1c should not be used for diagnostic purpose

SCREENINGS OF DM

As a large number of asymptomatic patients are meeting the diagnostic criteria, the risk of complications is higher. Thus, ADA recommends screening of all overweight individuals (BMI > 25kg/m^2) of 45 years and elders with periodic fasting plasma glucose and HbA1c assessment every three years. There are other recommendations for screening as following:

- A large number of individuals who meet the current criteria for DM are asymptomatic and unaware that they have the disorder
- Epidemiologic studies suggest that type 2DM may be present for up to a decade before diagnosis
- As many as 50% of individuals with Type 2 DM have one or more diabetes-specific complications at the time of diagnosis

- Treatment of Type 2 DM may favorably alter the natural history of DM. The ADA recommends screening all individual >45 years every 3 years and screening individuals at an earlier age if they are overweight (body mass index > 25 kg/m2) and have one additional risk factor for diabetes.

RISK FACTORS FOR TYPE 2 DM

There are many risk factors associated with Type 2 DM, some of them are discussed as following:

- Family history of diabetes:- parent or sibling with Type 2 DM
- Obesity: BMI > 25Kg/M^2, >23Kg/m^2 in Asian Americans
- Physical inactive
- Race/ethnicity:- African American, Latino, Native American, Asian American
- Previously identified with IFG, IGT or an Hb A1c of 5.7 – 6.4%
- History of GDM
- Hypertension
- HDL cholesterol level <35mg/dL ± TGs level > 250mg/dL
- Polycystic ovary syndrome or acanthosis nigricans
- History of cardiovascular diseases

PATHOGENESIS OF DM

Type 1 DM is a result of immune-mediated destruction of beta cells of the pancreas leading to deficiency of insulin. Even though it can occur at any age, but it commonly develops before the age of 20 years. The autoimmune process is thought to be triggered by an infectious and environmental stimulus. Autoantibodies are directed against islets cell molecules such as insulin, glutamic acid carboxylase (GAD), IA-2/ICA-512 (tyrosine phosphatases), and Zn T-8 (zinc transporters),which may serve as markers of an autoimmune process leading to beta-cell destruction. The individuals who have any one of above-mentioned autoantibodies can be sub-classified as having Type 1A, immune-mediated Type 1 DM [22, 23].

East and South Asian populations appear to develop Type 2 DM at a younger age and with lower BMI [26].Type 2 DM has a strong genetic component because children of diabetic patients have a 40 % higher risk of getting diagnosed with Type 2 DM. More than 70 genes have been implicated in the pathogenesis in this DM form [27].

Obesity, especially visceral or central (as evidenced by the hip-waist ratio), is quite common in Type 2 DM (≥80% of patients are obese), and it is considered to play a role in the pathogenic process. Putative environmental triggers include viruses (Coxsackie, rubella, enteroviruses most prominently), bovine milk proteins, nitrosourea compounds, vitamin D deficiency, and environmental toxins [24].

Insulin resistance and abnormal insulin secretion are central to the development of Type 2 DM associated with progressive beta-cell failure [25]. The relative contributions of each (insulin resistance and abnormal insulin) vary from individual to individual and are developed through different mechanisms. First, Hyperinsulinemia accelerates the process of atherosclerosis resulting in increased production of free fatty acids and some adipokines that causes insulin resistance in skeletal muscles and liver in a long-standing Type 2 diabetic patient [28]. Second, beta cells of the pancreas secrete amyloid polypeptide or amylin, which is deposited in islets and results in a negative influence on the secretion of insulin, leading to abnormal insulin. This is further supported by evidence that shows a 50% decrease in the beta-cell mass. In addition, a chronic hyperglycemic state deteriorates the milieu within the islets cells leading to glucose toxicity, which further worsens the hyperglycemia and this result in a vicious cycle. Therefore, in order to improve the function of islet cells, glycemic control is a must. Furthermore, elevated free fatty acids in long-standing diabetics provoke lipotoxicity leading to the formation of pro-inflammatory cytokines that further worsens the function of islet cells.

There are various kinds of Insulin resistance syndromes that are commonly associated with Type 2 DM, such as metabolic syndrome or syndrome X, and have a constellation of metabolic derangements

including insulin resistance, hypertension, dyslipidemia, central obesity, and accelerated heart diseases.

In the bargain, the myocardial infarction is 2-3 times as common in diabetics as in non-diabetics. In diabetic patients, heart disease is usually regarded as an expression of atherosclerosis, the development of which is thought to be amplified by diabetes mellitus[40]. In some cases, however, no atherosclerotic changes are found in coronary arteries and the term diabetic cardiomyopathy has been suggested for this condition. However, thus far it has not been put forward in a uniform way from the clinical and pathological aspects. In addition impaired functions of the left ventricular cavity have been observed [41]. Atherosclerotic vascular disease manifesting itself as coronary heart disease or cerebrovascular disease or peripheral vascular disease, occur at a marked frequency in diabetic patients than in non-diabetic patients. This excessive occurrence of atherosclerotic vascular disease in diabetic patients is only partially explained through adverse effects of diabetes on general risk factors of atherosclerotic vascular disease and it must be mainly caused by direct effects of diabetes itself although mechanisms that are so far not fully understood [42]. Diabetics especially those with severe microvascular complications have small vessel Involvement of the coronary microcirculation analogous to that in the kidney and retina, capillary microaneurysm, basement membrane thickening, and endothelial proliferation have been described in necropsy and biopsy studies. These small vessel abnormalities ultimately induce diffuse myocardial ischemia which results in extracellular fibrosis. These pathological changes would disrupt the active processes which determine changes in myocardial properties that are responsible for relaxation and filling. The role of diffuse ischemia is uncertain as a myocardial cell has a normal structure but may well be important in impairing function [13].

EFFECT OF DM ON PROGNOSIS OF HEART FAILURE (HF)

When a diabetic patient develops HF, the prognosis is generally poor. The data collected from the US Medicare includes >150,000

diabetic cases with age >65 years. Patients with both DM and HF had a hazard ratio (HR) for mortality of >10 with the narrowest confidence interval (CI) (HR =10.6; 95% CI: 10.4–10.9).

There has been a long period of discussion on the association between DM and HF. Also, to determine if it is an independent association or confounded by concomitant risk factors, namely CAD, HTN, or idiopathic.

Figure 2: DM and HF

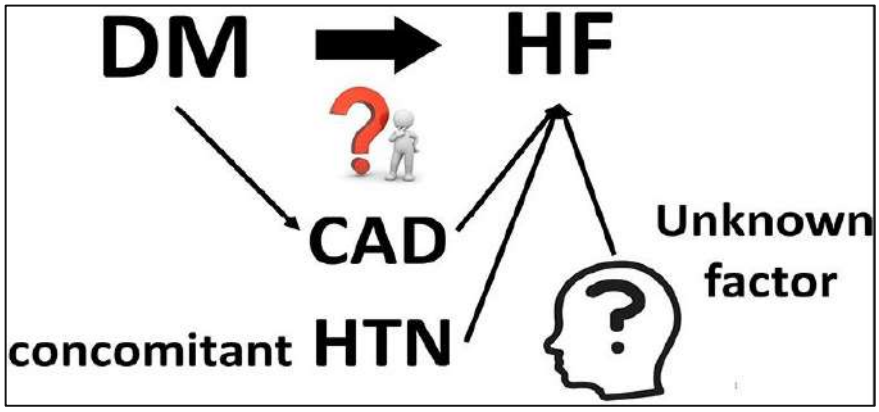


Table 2: Varies Studies

Study	Journal / Year	HR with DM
Framingham (4)	Am. J.,Cardio 1974	• Age >65 years: HR = 4 in men/ 8 in women; • Overall: 2.4 in men; 5.1 in women;
CV Health Study (5)	Am. J.,Cardio 2000	• HR = 1.74 (1.38 – 2.19)
UKPDS (6)	BMJ 2000	• HF risk related to HbA1c
Kaiser Permanente (7)	Diabetes Care 2001	• 45-54 years: 33 cases per 1000; • 55-64 years: 68 cases per 1000; • 65-74 years: 135 cases per 1000;
ALLHAT (8)	Circulation 2006	• RR = 1.95 for HF hospitalization/ death

HR- hazard ratio; RR-risk ratio; HbA1c compared with DM without HF (9). The findings are collaborated by several large clinical trials such as LIFE (HR for mortality was 5.98; 95% CI: 3.90–9.17; P<0.0001), and RENAAL (HR =3.99; 95% CI: 3.02–5.25; P<0.0001)[30]

CURRENT UNDERSTANDING OF DM AND HEART FAILURE

Based on the present data, ACCF/AHA guidelines for HF demonstrated diabetes as an independent risk factor for heart failure [31]. The revision of the guidelines classified heart failure into four stages (stages A to D) where Stage A means high risk of HF without any structural changes or symptoms since DM itself is a significant independent risk for HF. The definition of diabetic cardiomyopathy has been slightly modified from the initial definition by *Rubler et al.,* "ventricular dysfunction that occurs independently of CAD and HTN" to "diabetes-associated structural and functional myocardial dysfunction not related to other confounding traditional factors such as CAD, HTN, congenital or valvular heart diseases"[32,33,34].

Diabetic cardiomyopathy is classified into two types: restrictive [similar to HF with preserved EF >50%] and dilated (HF with reduced EF <50%). Restrictive diabetic cardiomyopathy is characterized by coronary microvascular endothelial dysfunction and metabolic rearrangements (hyperglycemia, lipotoxicity, and obesity), whereas dilated cardiomyopathy is characterized by cardiomyocyte cell death and autoimmune disorders (Type 1 DM). Both of these cardiomyopathies have some common features, such as coronary microvascular rarefaction and advanced glycogen end product (AGE) deposition.

In addition, insulin resistance and hyperinsulinemia play an essential role in the mechanism of diabetic cardiomyopathy [35]. They increase the risk of systemic metabolic disorders and activate the sympathetic nervous system resulting in autonomic dysfunction. Next, the renin-angiotensin-aldosterone system is activated and results in oxidative stress, mitochondrial dysfunction, endoplasmic

reticulum stress, and impair calcium channel homeostasis. These effects cause cardiac fibrosis, hypertrophy, cardiomyocyte death, dysfunction of the coronary microcirculation, and eventually heart failure. Furthermore, these pathophysiological changes in cardiomyocytes underlie the risk factors for insulin resistance and hyperinsulinemia, and so on.

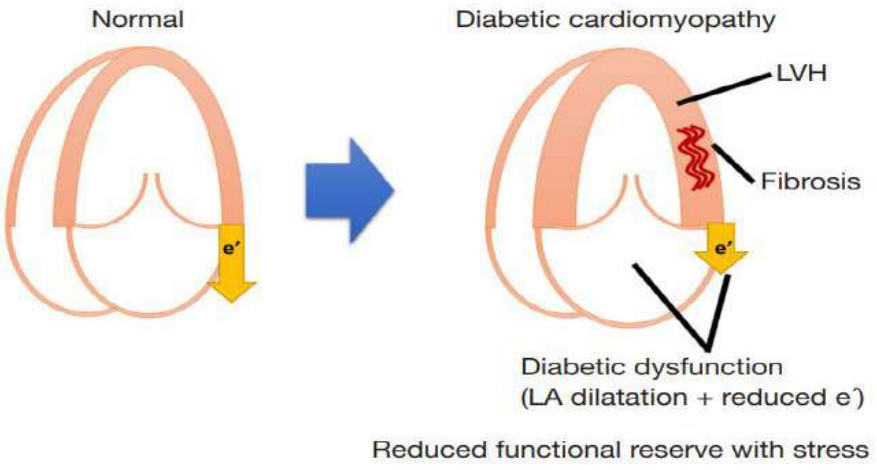


Figure3. Schematic illustration of Diabetic Cardiomyopathy.
(LVH: Left Ventricular Hypertrophy; LA: Left Atrial)

SCREENING

The meta-analysis has identified four key independent risk factors for heart failure and diabetic cardiomyopathy. They include the history of CAD, age (every 5 years), poor glycemic control markers (i.e., insulin use, high fasting glucose, and HbA1c of >9.0%), and HTN[36]. In routine clinical practice, the screening should comprise the history of the patient based on the above mentioned four factors, physical examination, including blood pressure assessment, blood tests for glycemic control, and electrocardiography (ECG) for CAD and LVH. In the screening of asymptomatic subjects with risk factors (stage A HF), cardiac imaging plays an important role, so the majority of data in the literature is based on echocardiography findings.

COMPLICATIONS OF DM

The complication of diabetes depends on its chronicity and affects many organs leading to morbidity and mortality. These chronic complications are divided into two categories vascular and non-vascular. Microvascular complications of both, Type 1 and 2 DM are directly associated with chronic hyperglycemia, according to randomized clinical trials. They have demonstrated that a reduction in chronic hyperglycemia prevents or delays the microvascular complications such as nephropathy, neuropathy, and retinopathy [29]. Many patients have indistinguishable microvascular complications despite glycemic control, suggesting a genetic susceptibility for such complications [27].

RISK FACTORS FOR COMPLICATION OF DM

In terms of macrovascular complication, risk factors are older age, smoking history, and previous diagnosis of high cholesterol levels, while being female and a high level of physical activity demonstrated a protective effect. Next, the risk factors for microvascular complications were longer duration since diagnosis, smoking history, and a previous diagnosis of hypertension. Achieving a third-level or higher education and high levels of physical activity demonstrated a protective impact.

TABLE 3: INCIDENCE OF VARIOUS COMPLICATION OF TYPE 2 DM

Heart Disease and Stroke	At least 68% of people aged 65 or more with diabetes die from some form of heart disease and 16% die of stroke[37]. Adults with diabetes are two or four times more likely to have heart disease or a stroke than adults without diabetes. In 2004, heart disease was noted on 68% of diabetes-related death certificates among people aged 65 or older. In 2004, stroke was noted in 16% of diabetes-related death certificates among people

	aged 65 or older.
Hypertension	Between 2005-2008, adults aged 20 or older with self-reported diabetes, 67% had blood pressure greater than or equal to 140/90 mmHg or used prescription medications for hypertension.
Blindness and other Eye Problems	Diabetes is the leading cause of blindness among adults aged 20-74. Between 2005 -2008, 4.2 million (28.5%) people aged 40 or older had diabetic retinopathy, and 655,000 (44% of those with diabetes) of them had advanced diabetic retinopathy that could lead to severe vision loss.
Renal Diseases	Diabetes is the main cause of renal failure, accounting for 44% of all new kidney failure cases. In 2008, 48,374 people with diabetes began treatment for end-stage kidney disease. A total of 202,290 people with end-stage kidney disease due to diabetes lived on chronic dialysis or with a kidney transplant
Peripheral Neuropathy	Peripheral neuropathy (PN) is a major factor in the occurrence of foot ulcers in diabetic patients [38]. The prevalence and pattern of PN vary from country to country, from as low as 1.5% to as high as 100 % in patients with Type 2 diabetes, depending on the screening approaches, diagnostic criteria, and study population[39]. The neuropathy may be silent and go undetected. Up to 7.5% of patients with Type 2 diabetes have clinical neuropathy at the time of diagnosis. Type 2 diabetes may be asymptomatic, and neuropathy may be the first indication of the presence of diabetes.

PREVENTION OF DM

Early detection of period of impaired glucose tolerance (IGT), lifestyle modifications play a central role in the prevention of Type 2 DM. There are various diabetes prevention programs focused on lifestyles modifications like diet and exercise for 30 min/day five times/week for individuals with IGT. Individuals with family history of Type 2 DM and IGT should be heartened to maintain a normal BMI and regular physical activity. People with IGT or an HbA1c of 5.7 -6.4% should be monitored annually to detect the early diagnosis of diabetes.

Guevara et al. retrospectively studied 73 patients with juvenile diabetes with a mean duration of 42.9 years, 55% of patients showed clinical evidence of retinopathy, nephropathy was seen in 59 % of patients, and neuropathy was demonstrated in half of them. A significant peripheral vessels system impairment was present in 40% and major cardiac complications in 20% [43].

Factor et al. demonstrated saccular and fusiform microaneurysm in heart of diabetic patients. Extensive interstitial fibrosis was also found but its pathogenesis was not known [44]. *Mcmillan et al* outlined the possible contribution of seven categories of diabetic changes to damage of the microcirculation. These include**:**

1. Altered basement membrane
2. Altered cellular function
3. Cell metabolic changes
4. Altered blood properties
5. Disturbed homeostasis
6. Altered oxygen transport
7. Altered hormone production

The variety of clinical manifestations in long-standing diabetes related to microangiopathy appears to be due to a combination of the variables, overall rate of progression, a deferring ability of the body tissues and organs to accommodate the circulatory changes [45]. *Moore et al.* suggested that cardiac cell hypertrophy is usually accompanied by an increase in connective tissue so that the proportion

of myocardium consisting of connective tissue remains unchanged at light microscopic levels [46].

Ledet et al. did a quantitative morphological study of the heart of young diabetics and non-diabetics patients. The results showed that arteriolar dilatation and a strongly PAS-positive stained vessel wall occurred at a higher frequency among diabetics and the number of cells in tunica media was increased as compared to non-diabetics. There were no indications of endothelial proliferation and capillary wall thickening. The number of capillaries per square millimeter of the heart muscle was the same in the both groups [40].

Several clinical and experimental studies have demonstrated abnormal myocardial cell function in diabetes mellitus. *Gotzche et al*. demonstrated several abnormalities in the intracellular handling of calcium in myocardium from diabetic rats. A remarkable adenyl cyclase system and the abnormal intracellular calcium transport may be the essential factors for abnormal contraction patterns of the diabetic heart [47]. *Williams et al.* studied the effects of experimental diabetes on adrenergic and cholinergic receptors of rat myocardium and showed that diabetic hearts had 27% fewer beta-adrenergic receptors and 31% fewer alpha-adrenergic receptors than controls. Food restriction did not affect receptor characteristics and the treatment of diabetic rats with insulin prevented any down regulation of cardiac alpha or beta-adrenergic receptors [48].

Ledet et al. studied histological and histochemical changes in coronary arteries of diabetic and non-diabetic patients. He demonstrated that the distal part of the extramural coronary artery contained more hyaline, PAS-positive material and fat in the intima was more in diabetics than non-diabetics. There was more calcium in proximal as well as the distal part of coronary arteries for-diabetics. There was no endothelial proliferation, no measurable difference in the wall thickness of the smallest intramural vessels between diabetics and non-diabetics. The incidence of PAS-positive small vessels of the myocardium was closely related to the incidence of nodular glomerulosclerosis in the kidney [49].

Nunoda et al. quantitatively measured the diameter of right ventricular myocardial cells and diffuse perimysial fibrosis of biopsied myocardium. The mean diameter of right ventricular myocardial cells in patients with diabetes mellitus was significantly large and the percentage of fibrosis was significantly higher than that of controls. There was no significant correlation between the histopathological measurements and clinical features [50].

Sutherland et al. compared endomyocardial biopsies of IDDM with non-diabetic subjects. Arteriolar hyalinization, arteriolar thickening, and interstitial fibrosis were observed in diabetic patients. Morphometry performed on electron micrographs showed no significant difference in the thickness of the capillary basal lamina between diabetics and controls. It was observed that the abnormalities of cardiac functions described in diabetes are not associated with the thickening of the myocardial capillary basal lamina [51].

Regan et al. did a hemodynamic study on 17 diabetic adults or familial type without hypertension and obesity. There were no occlusive lesions on angiography for 12 of these patients, none had local dyskinesia, and 8 patients from the group without heart failure had a modest, but significant elevation of left ventricular end-diastolic pressure. End diastolic and stroke volume were reduced, but ejection fraction and mean rate of fiber shortening were within normal limits. The left ventricular end-diastolic pressure/volume ratio was significantly higher than controls. After local increments a significant increase of filling pressure was detected compared to normal without a stroke volume response and consistent with preclinical cardiomyopathy.

Post-mortem studies were performed in 11 uncomplicated diabetics, nine were without significant obstructive disease of the proximal coronary arteries and majority had succumbed with cardiac failure. None have evident luminal narrowing of the intramural vessels. All nine exhibited PAS-positive material in the interstitial collagen accumulation was present in perivascular loci between myofibrils or as replacement fibrosis. Multiple samples of the left ventricle and septum revealed enhanced triglyceride and cholesterol than controls. Thus a

diffuse extravascular abnormality may be a basis of cardiomyopathic feature in diabetics [52].

Due to a lack of suitable in vivo measurement techniques, cardiac chambers, walls, and great vessels have not been accurately Figureed in the past. Some of these measurements were done in angiography, while others at the time of surgery as non-dynamic measurements made at autopsy. Electrocardiography, ventriculography, and other techniques gave only an indirect assessment, and measurements based on them usually failed to confirm precise anatomic measurements.

Edler introduced the sonar technique for the study of heart in vitro experiments and it proved that the interfaces between the ventricular walls and blood produced have strong echos [53]. Echos from epicardium to posterior left ventricular wall and pericardium were identified in vivo by Feigenbaum [54] and associates during the studies of pericardial effusion and confirmed by injection of saline into the pericardial sac of a dog under ultrasonic guidance [55]. The echos arising from the endocardial surface of the posterior left ventricular wall and both sides of the interventricular septum were subsequently identified as an important confirmation of the origin of the cardiac echoes following the discovery that injection of fluid by catheter into the cardiac chambers of great vessels during an ultrasound examination greatly increased reflection of ultrasound by the contained blood and hence transiently opacified lumen [56].

This way, the walls of chambers could be identified with certitude. Feigenbaum et al. used this technique to prove the identity of the echos postulated to arise from the endocardial surfaces of the septal and posterior walls of the left ventricle [57].

In the year 1971, the clinical application of external ultrasound to the examination of the heart began with the discovery of echos from the anterior leaflet of the mitral valve by Edler and Hertz. Edler subsequently described that echos are arising from the tricuspid valve, left ventricular outflow tract, aortic valve, and pulmonary artery. He also recognized the abnormal appearance of the ventricular enlargement in

patients with ASD, left atrial myxoma, and pericardial effusion. M-Mode echocardiography has rapidly achieved popularity as a non-invasive technique for obtaining quantitative dimensional measurements for cardiac chamber size, wall thickness, wall motion velocities, great vessels dimension, and valves [58].

Three factors affect the accuracy of primary echocardiographic measurement are:

1. The theoretical resolution of echocardiographic systems
2. The variability in interpretation and measurement of the clinical echocardiogram.
3. The overall technical quality of the derived echocardiographic pace.

Besides the limitation of M-mode echocardiography includes:

1) M-mode measurement is not a true dimension.
2) The relationship between m-mode measurement and true minor dimension varies from patient to patient.
3) Limited echocardiographic window due to limited intercostal space
4) M-mode measurements are not spatially corrected.
5) The relationships of the m-mode ultrasonic beam to the heart may change as geometry of the left ventricle changes.

Systolic Time Interval by Echocardiography

The duration of the phase of left ventricular systole is thought to provide information concerning the performance of the left ventricle. The movements of one or two of the aortic valve cusps can be traced with high-frequency pulsed ultrasound. Apart from their diagnostic value, such recordings provide evidence of the precise moment of the opening and closing of the aortic valve. Therefore together with simultaneous electrocardiogram, they should also permit determination of the systolic time intervals. However, there are some limitations of the study of systolic time interval namely, a satisfactory aortic valve echocardiogram cannot be always recorded and incomplete image of cusps.

Measurements of the Mean Rate of Circumferential Fibre Shortening (vcf) in man

Cooper et al. concluded that ultrasound determination of mean vcf is a valid method for distinguishing normal from the abnormal myocardial performance of the left ventricle. This data also support the use of ultrasound in the determination of ejection fraction [59]. The limitations of these methods are:

1. Patients with wall motion abnormalities may have falsely normal ejection fraction.
2. In patients with abnormal wall motion, they may have an area under visualization not representative of true left ventricular function.
3. In a study by Feiginbaum et al mean LVPW thickness was 1.1+0.2 cm. These findings have been further verified at the time of surgery and autopsy.

LV Mass

Echocardiography is a method to estimate left ventricular mass. It is a simple non-hazardous, accurate, and reproducible.

M-Mode methods have been used for estimating left ventricular mass [60]. However, this method has a significant limitation that they use the dimension to extrapolate a three-dimensional quantity, myocardial volume. According to Gupta et al. the Indian population has a upper limit of normal LVM (mean +-2SD), is defined as [61] LVM in MEN = 116.07g/m2; LVM in Women =104.36g/m2.

Septal and Posterior Wall Excursion Measurements

These are measured from M-mode echocardiogram. The normal measurements by *Kounis et al.* [62] in 50 adults were as:

- Post wall excursion 11.1+- 0.27 mm
- Mean post wall velocity 37.5+-1.0mm/sec
- Systolic septal excursion 5.4+-0.1 mm
- Systolic septal velocity 19.8+-0.6mm/sec
- Diastolic septal excursion 6.1 +-0.2mm
- Diastolic septal velocity 24.2+-0.8mm/sec

Left Ventricular Volumes and Functions:

The ability to measure left ventricular volumes during the cardiac cycles allows the characterization of the mechanical or pump function of the heart. Such determinants permit measurement of left ventricular stroke volume, quantification of regurgitate or shunt flow, characterization of ventricular wall stresses, estimation of lv mass, and evaluation of velocity of circumferential shortening further. Several studies have stressed the clinical utility of left ventricular ejection fraction, which is derived from volume measurements, as an index of myocardial pump function. The American society of echocardiography recommended that left ventricular volumes be computed from the dimensions and area measurements contained from paired apical views (both two and four chambers) that may be considered nearly orthogonal.

Echocardiographic Determinants of Blood Flow

Doppler echocardiography is the most direct and theoretically the most accurate echocardiographic technique for assessing blood flow.

Aortic flow

As aortic flow is the blood that perfuses the systemic circulation, it provides a measure of cardiac output. The technique that has been most utilized is recording the mean velocity of the blood flow in the ascending aorta using Doppler echocardiography. The Doppler recording of the ascending aortic blood can also be used to evaluate left ventricular function. The peak velocity and the rate of acceleration may be related to the vigour with which the left ventricle can contract.

Mitral Valve Flow

There are essentially two phases of the flow. The first occurs in early diastole (E) and the second following atrial systole (A). Normally, the peak velocity is greater with the early diastolic flow. Data demonstrate that the Doppler mitral velocity can be converted to flow if one calculates the mitral valve orifice. The quantitative assessment of flow into the left ventricle also has diagnostic value. In patients with

reduced compliance, the early diastolic flow is altered. The peak velocity (E) is diminished and the rate of decrease in early flow is also reduced. Furthermore, the peak velocity following atrial systole (A) is measured in both absolute and relative forms when compared to early diastolic velocity.

Cardiac Output:

Cardiac output can be calculated from the blood velocity in the ascending aorta (measured by doppler ultrasound) combined with aortic surface area (measured by cross-sectional echocardiography). Cardiac output has been, measured by the Doppler method and has come out to be 4.45 to 6.35 liters per minute in a study by Robson et al. [63]

Diastolic Function

Doppler echocardiography has been used to assess left ventricular diastolic function in patients with various cardiac diseases and normal subjects. The indices of the diastolic function obtained by Doppler echocardiography have also been shown to correlate well with those measured by either contrast angiographically or radionuclide angiography. Some determinants of left ventricular filling assessed with Doppler. However, seem to be affected by age, such as age-related changes in the left ventricular filling pattern may be important in defining normal values of Doppler indices of diastolic function [64].

Spirito et al. obtained Doppler echocardiographic measurements of isovolumic relaxation, early and late filling phases of diastole in a group of healthy volunteers with a wide range of ages[65]. Left ventricular diastolic filling is a complex phenomenon influenced not only by the intrinsic properties of the cardiac muscle, but also by variables such as left ventricular mass and volume, systolic function, heart rate, and the loading conditions of the ventricle.

Shapiro et al. studied left ventricular diastolic functions in 142 diabetics (free from heart diseases), 20 normal subjects and 60 patients had coronary artery disease. Diastolic variables of left ventricular function were normal in the 12 young diabetic patients with no complications. Significantly delayed mitral valve opening relative to

minimum dimensions and aortic valve closure was found in all other groups of diabetics. 44 diabetic patients had severe microvascular complications with significantly reduced peak rate and prolonged duration of wall thinning and dimension increase. The abnormalities were unlike those found in subjects with coronary artery disease. These studies show that the primary cardiac abnormality in diabetic microangiography was prolonged duration and reduced rate of posterior wall thinning with impaired left ventricular dimension that increases, reflecting abnormal myocardial properties [13].

Ahmed et al. examined left ventricular performance in diabetic patients without clinical evidence of myocardial ischemia or other cardiovascular diseases by using a non-invasive technique, systole time intervals. The diabetic subjects had a shorter left ventricular ejection time, longer pre-ejection period/left ventricular ejection time. The isovolumic time was prolonged, while heart rate and arterial pressure were within normal limits.

The abnormal function was independent of apparent duration and treatment by diet alone, Insulin, or hypoglycemic agents. Based on available morphologic data in human and canine diabetics, alteration of myocardial interstitium may be the basis for this preclinical abnormality in diabetic patients [66].

Vanninen et al. studied left function and dimensions in 26 men and women with newly diagnosed non-insulin-dependent diabetes mellitus in 13 healthy men and women. The diabetic men had a lower peak filling rate normalized to mitral stroke volume than in the control men. The diabetic women had increased LV mass and decreased fractional shortening compared to control women.

After 3 and 15 months, 23 diabetic men and 15 women were re-examined. Concomitantly with decreasing blood glucose level, fractional shortening improved mainly during the first 3 months and was significantly higher in both diabetic men and women at 15 months than at baseline. In diabetic men, peak filling rate increased at 15 months. The 15 months peak filling rate was correlated with autonomic nervous function assessed as heart rate variability during deep breathing tests

in a diabetic men who also showed an inverse correlation between LV hypertrophy and heart variability throughout follow up. These preliminary results demonstrate that both systolic and diastolic function improve concomitantly with declining blood glucose levels in newly diagnosed type 2 diabetics [67].

Takahashi et al. studied left ventricular dysfunction during dynamic exercise in Type 2 DM with retinopathy. His data indicate that diabetic patients with retinopathy relied on the enhanced ventricular filling in maintaining stroke volume during exercise. Thus, retinopathy is associated with impaired left ventricular systolic functions in Type 2 diabetic patients [68].

Uusitupa et al. also showed improvement of diastolic function in middle-aged Type 1 and Type 2 diabetic patients who were free of cardiovascular disease. The impaired diastolic filling among diabetic patients did not show any relationship to the duration and metabolic control of diabetes or the presence of microangiopathy [69].

Zarich et al. concluded that the left ventricular diastolic filling abnormalities in diabetic patients did not correlate with duration of diabetes, retinopathy, nephropathy, and peripheral neuropathy. Doppler echocardiography may offer a reliable non-invasive way to assess diastolic function and to follow up diabetic patients serially for any deterioration in cardiac status before the appearance of clinical symptoms[70]. The solved study further confirmed the association of diabetes mellitus and systemic hypertension with LV dysfunction, first established by the Framingham group.

The possibility that both diabetes mellitus and systemic hypertension may be linked to LV dysfunction, independent of their respective roles as risk factors for ischemic heart disease is also suggested [71].

Vered et al. demonstrated that diabetes mellitus may cause exercise-induced global LV dysfunction in a young man with no evidence of cardiovascular disease. This phenomenon does not seem to follow the known course of diabetic microvascular complications [72].

Perez et al. demonstrated abnormal myocardial acoustic properties in diabetic patients and connected it with the severity of the disease. The analysis of data showed a reduction in cyclic variation of backscatter was greatest in patients with diabetes who had neuropathy. Retinopathy and nephropathy were associated with abnormal myocardial acoustic properties as well [73].

Dash et al. concluded that there is an increased prevalence of cardiomyopathic syndrome in diabetic patients with coronary artery disease, compared with non diabetic patients with coronary artery disease, and this difference exists independently of hypertension and hyperlipidemia [74].

Mildenberger et al. evaluated left ventricular function at rest and during supine bicycle exercise of gated radionuclide angiography. His data suggested that one-third of patients with diabetes have subclinical left ventricular dysfunction without correlation to risk factors for atherosclerosis or other diabetic complications [75].

Shapiro et al. did a prospective study of heart disease in 69 untreated maturity-onset diabetes without clinical heart disease. And, demonstrated that coronary artery disease was common in diabetes mellitus and seven patients demonstrated ventricular wall dyskinesias in the absence of symptoms. A small group had slow ejection and relaxation, probably a result of increased left ventricular stiffness from myocardial involvement by diabetic microvascular disease [76].

Rynkiewicz et al. examined systolic and diastolic time intervals in young diabetic men with no apparent heart disease. 23% of patients had an abnormal systolic time interval, 54% an abnormal diastolic time interval, and 23% had both abnormal intervals [77].

Airaksinen et al. documented impaired left ventricular filling in young diabetic females and suggested that minor abnormalities in LV function reflecting stiffness of myocardium are common in young female diabetics. A patient group with a relatively low prevalence of artery disease[78].

Margonato et al. measured abnormal cardiovascular response to exercise in young asymptomatic diabetic patients with retinopathy and concluded that diffuse microangiopathy, alone or in combination with neuropathy might be responsible for impairment of cardiovascular functions in diabetes [79].

Takenaka et al. studied left ventricular filling determined by Doppler echocardiography in diabetes mellitus. The observation and the results of the study indicate that even when a systolic function is impaired, diabetics can microangiopathy[80].

Mustonen et al. studied left ventricular systolic function during exercise in middle-aged insulin-dependent and non-insulin-dependent diabetic subjects without clinically evident cardiovascular disease. The results of the study indicated that LV dysfunction on exercise may occur in both types of diabetic patients without any evidence of myocardial ischemia [81].

Mantysaari et al. documented that ventricular repolarization impairment with disturbed left ventricular sympathetic function and diastolic filling in diabetes. This suggested that the ventricular repolarization abnormality can be linked with the mechanism between sympathetic neuropathy and impaired left ventricular diastolic filling in diabetes [82].

Gotzsche et al. studied abnormal changes in transmitral flow after acute exposure to nitroglycerine and nifedipine in uncomplicated insulin-dependent diabetes mellitus by Doppler echocardiography [83].

Jaffe et al. analyzed the incidence and severity of congestive heart failure and subsequent death concerning infarct size in diabetic and non-diabetic subjects. The mortality rate was greater in diabetic patients and increased incidence of CHF despite a smaller infarct size suggested that additional factors must be contributing to myocardial dysfunction and the resultant excess in mortality [84].

Chlumsky LJ recorded deterioration of diastolic filling of the left ventricle in Type 1 and Type 2 diabetics. Short term compensation led to improvement only in Type 2 diabetics with diabetic retinopathy. The results supported the effects of close compensation of diabetes, as

decompensation in patients without late complications leads to deterioration of diastolic filling of the left ventricle, which at first after compensation is reversible[85].

Tong et al. showed a positive correlation between the duration of late potential, malignant ventricular arrhythmias, and sudden cardiac death so that measurement of VLP might be a new and valuable technique to detect subclinical diabetic cardiomyopathy, and to predict ventricular arrhythmia attack and sudden death in diabetic patients [86].

Grossman et al. concluded that diabetes accelerated the development of left ventricular hypertrophy in patients with essential hypertension, independent of arterial pressure. Therefore, may contribute to the increased cardiovascular morbidity in patients with hypertension [87].

Mathew et al. determined that young patients with diabetes mellitus have a normal left ventricular diastolic function and the minor transmitral flow abnormalities are possibly due to autonomic dysfunction [88].

Hiramatsu et al. suggested that LV diastolic filling is impaired in mildly hypertension patients with non-insulin-dependent diabetes mellitus without severe complications, the abnormalities being more intense in patients with retinopathy. A short term glycemic control results in a marked decrease in abnormalities in patients without retinopathy [89].

Ferraro et al. compared the left ventricular function in insulin and non-insulin-dependent diabetes mellitus. Ejection fraction at rest and exercise did not differ in both groups. Cardiac output and systemic vascular resistance did not differ between patients with IDDM and control subjects. In contrast, patients NIDDM had significantly reduced cardiac output compared with the control and increased systemic resistance. In patients with IDDM, the peak ejection rate, peak filling rate was significantly greater than the controls [90].

Mildenberger et al. and *Lababidi et al.* have also found ventricular dysfunction in young diabetic patients and found a correlation of ventricular dysfunction with the duration of diabetes [75,91].

Parameters of left ventricular diastolic filling are useful indicators of diastolic left ventricular functions. These findings have been validated by comparison with cine angiography by *Rokey R et al.*[92] The impairment of LV relaxation and impaired diastolic filling in hypertension were documented by *Szlachcic et al.*[93]

Noolan et al. have studied the influence of atrial contraction and mitral valve mechanics on left ventricular filling[94]. The abnormalities of various diastolic events in health and various diseases have been evaluated by *Hammermeister et al.* [95]

Takenaka et al. studied the effects of left ventricular size on early diastolic ventricular filling in neonates and adults. He concluded that peak early diastolic mitral flow velocity is independent of LV size. Since peak LV filling rate is equal to the product of peak mitral flow velocity and mitral valve area, the correlation between peak early diastolic LV filling rate and LV size is probably due to differences in the mitral valvular area rather than the difference in peak mitral flow velocity[96].

Mikael Kjaer Poulsen et al. study concluded that the prevalence of LV diastolic dysfunction in 305 patients was high in patients with T2DM with no history of cardiovascular disease. The study suggested a close association between the presence of advanced LV diastolic dysfunction and abnormal myocardial perfusion. Thus, findings support that moderate or severe LV diastolic dysfunction and LA dilation in the early phase of T2DM is closely associated with intrinsic LV dysfunction [97].

Exiara et al. in their study of 114 subjects stated that the prevalence of LV diastolic dysfunction in normotensive, asymptomatic, and well-controlled DM Type 2 patients is high and increases with age [98].

Mishra et al. in their case-control study of 71 subjects with type 2 DM found that asymptomatic diabetic patients have reduced LV systolic and diastolic function as compared with healthy subjects. LV systolic and diastolic abnormalities are correlated with the duration of diabetes and with diabetic microangiopathies, like retinopathy and neuropathy [99].

Soldatos et al. in their case-control study of 55 individuals with

Type 2 DM found that diastolic dysfunction, present in a significant proportion of the population with Type 2 DM [100].

Sacre et al. found that there was an independent association between global cardiac autonomic neuropathy (CAN) and left ventricular (LV) dysfunction in patients with Type 2 DM [101].

Masugata et al.'s case-control study of 77 normotensive patients found that the cardiac diastolic dysfunction without LV systolic dysfunction in patients with well-controlled Type 2 DM is related neither to hypertension nor LV hypertrophy, but rather to aging and the duration of type 2 DM [102].

Annonu et al. did a case-control study of 66 subjects found that there was an inverse correlation between the duration of diabetes and E/A ratio. E/A ratio < 1 was associated with a higher prevalence of retinopathy, and abnormal blood pressure response to standing. LV systolic and diastolic abnormalities are correlated with the duration of diabetes and with other diabetic microangiopathies, such as diabetic retinopathy and neuropathy [103].

Sohail et al. studied 212 diabetic population found that 30.76% of patients with Type 2 DM had diastolic dysfunction. The LV diastolic dysfunction is much more prevalent in patients with Type 2 diabetes mellitus and LV diastolic dysfunction is an early marker of diabetic cardiomyopathy [104].

Diamant et al. stated that early (E) acceleration peak, deceleration peak, peak filling rate, and E/A ratio, and all other indices of diastolic function were significantly decreased in patients with recently diagnosed, well-controlled, and uncomplicated Type 2 diabetes compared with the controls ('*P*' < 0.02)[105].

Bonito et al. stated that an impairment of LV diastolic function occurs early in the natural history of Type 2 DM, and is related to clinical evidence of microangiopathic complications [106].

Aaron et al. study of 1,760 diabetic patients found that 411 (23%) patients had diastolic dysfunction. Diabetic patients with diastolic dysfunction had a significantly higher mortality rate compared with those without diastolic dysfunction. An increase in the TDI velocity of

the medial mitral annulus during passive filling (E/e') ratio in diabetic patients is associated with the subsequent development of HF [107].

Boyer et al. stated that the prevalence of LV diastolic dysfunction in asymptomatic, normotensive patients with Type 2 diabetes disease is high. Diastolic dysfunction was found in 75% of subjects. They also found that TDI detected diastolic dysfunction more often than any other echocardiographic parameter [108].

Poulsen et al. in their prospective observational study of 305 patients with type 2 DM found that abnormal LV filling is closely associated with abnormal myocardial perfusion on myocardial perfusion scintigraphy[97].

Takeda et al. studied 544 consecutive Japanese DM patients with ejection fraction ≥ 50%, found that diastolic dysfunction (impaired relaxation) plays a crucial role in the induction of HF with normal systolic function in DM patients, regardless of the severity of DM and renal dysfunction [109].

Poanta et al. in their study of 58 subjects found that cardiac autonomic neuropathy was associated with LV diastolic dysfunction in patients with Type 2 DM, but without clinical manifestation of the heart disease [110].

Poirier *et al.* stated that diastolic dysfunction and CAN (cardiac autonomic neuropathy) are associated in patients with otherwise uncomplicated well-controlled Type 2 DM [111].

Hameedullah *et al.* in their study population of 60 patients with Type 2 DM found that there was a strong correlation between HbA1c level and diastolic indices ('*P*' < 0.05). Diastolic dysfunction was more frequent in poorly controlled diabetic patients, and its severity is correlated with glycaemic control. Similarly in our study, HbA1c > 7.5 % had higher prevalence of diastolic dysfunction compared to HbA1c < 7.5% [112].

C.M. Schannwell et al. studied a population of 87 subjects concluded that even young subjects with diabetes mellitus suffer from diastolic dysfunction, while the systolic ventricular function is normal [113].

Ricardo Fontes-Carvalho et al. conducted a study that concluded that Insulin resistance is associated with a diastolic function [114].

MATERIAL & METHODS

The study was conducted in the departments of Medicine, Endocrinology and Cardiology at Dayanand Medical College and Hospital, Ludhiana, Punjab, India between 2018 and 2020. Subjects were 300 DM patients who either came for regular health check-up at the OPD or were admitted in the medicine ward. The informed consent was obtained from the participants after explaining them about study in their first language, Punjabi or Hindi.

SCREENING OF PARTICIPANTS

The subjects were clinically evaluated and information about specific parameters was collected. These parameters include duration of diagnosed with DM, hypertension, BMI, blood glucose levels, renal function test, and ECG. Also, cardiovascular autonomic function assessment was also performed by calculating the heart rate response to three different activities: deep respiration, standing position and valsalva manoeuver. In addition, blood pressure was measured twice, five minutes after supine test and at the time when echocardiogram was done. It was taken by using Sphygmomanometer where korotokoff's Phase I and V was regarded as systolic and diastolic BP pressures respectively and calculating the mean values for systolic and diastolic blood pressure.

Selection Criteria:

- **Inclusion Criteria:-** Type 2 DM patients who are diagnosed with diabetes for a duration of more than 7 years and have no symptoms of cardiovascular involvement and, ECG with changes
- **Exclusion Criteria**:- Type 2 DM patient who have cardiac diseases such as obstructive sleep apnea, valvular heart disease, CHF, cardiomyopathy, and creatinine > 2mg/dL

After selection of the participants, five variables were recorded of all eligible subjects as followings:

1. Weight
2. Height
3. Body Surface Area
4. Blood Pressure
5. Detailed echocardiographic evaluation

Performed investigation tests were as follows.

1. Blood Glucose levels at Admissions: FBS, PPBS
2. LFT, RFT, Electrolytes, Uric acid
3. HbA1c
4. Fasting lipid profile
5. Chest X-rays
6. Echocardiography

Echocardiographic assessment was performed Philips Affinity 50C 7 Echo machine using 2.5 and 3.5 MHz phased array transducer having facilities of M-mode, 2-D, Pulse doppler flow imaging. Echocardiography evaluation included estimation of the followings 4 categories, which are discussed in detail.

A. Dimensions of left-sided cardiac chambers
B. LV mass
C. LV volumes
D. Left Ventricular Functions.

A) Dimensions of Left-Sided Cardiac Chambers: The measurements of the aortic root, LA, LVPW thickness and IVS in systolic and diastole, LV dimensions in diastole (LVIDd) and systole (LVIDs) was done in parasternal long-axis view, putting the participate in left lateral decubitus position as recommended by the committee on M-mode standardization of American society of echocardiography using 2-D Echo guided M-mode study.

i. *Aortic Root*: measured at the aortic valve level at the end of the diastole.

ii. **Left Atrium*:*** measured during systole and it includes the thickness of the posterior wall of the aorta, which was excluded from the aortic measurements. The measurements were made after performing a sweep and demonstrating the lines in the left atrium, which are in continuity with the left ventricular posterior wall.

iii. **Timing of End-Diastole for Wall and Cavitary measurements:** measured at the onset of QRS complex because there is variability in identifying end-diastole and morphology of QRS complex (it was kept in mind that the onset of the QRS does not represent the real end-diastole).

iv. **Cavities and walls:** (definition of a standardized plane): measured with regards to levels where the mitral valve leaflets occupy a larger portion of the left ventricular cavity in an adult's heart. The transducer was perpendicular to the chest wall or pointed slightly interiorly and laterally at the end of the long axis and "T" scan sweep as measurements were obtained.

v. **Left Ventricular Septum and Posterior Wall Thickness and Left Ventricular End-diastolic Cavity Dimension:** With good visualization of both right and left septal surfaces and onset of the QRS, septal thickness, posterior wall thickness, endocardial and epicardial surfaces were imaged clearly and measured along with the end-diastolic dimension of left ventricle wall. Cavitary measurements were made in general but relying on a leading-edge methodology (from the anterior-most edge of endocardial lines) and using the thinnest continuous lines.

vi. **Left Ventricular Systolic Dimensions:** measured at the nadir of septal motion in patients with normal septal motion.

vii. **Mitral Valve:** The characteristic pattern of mitral valve movements was studied by obtaining M-mode tracing of mitral valve guided by 2-D imaging in the parasternal long-axis view as per recommendation of the American

echocardiographic Association. The following parameters were measured:

a. Early diastolic anterior Mitral valve (AML) excursion.

b. Early diastolic Mitral valve leaflet separation: distance between AML and PML at peak of the early diastolic excursion.

c. EPSS

d. EF Slope

e. Mitral valve opening rate.

f. Early diastolic AML opening rate measured from DE slope.

g. Early diastolic AML closure rate measured from EF slope.

h. EPSS distance between the IVS and AML at the maximum early diastolic excursion – E point.

B) LV Mass: Estimated by using a single plane Simpson's rule.

C) Estimated LV Volume: estimated by using the single-plane Simpson rule at end-diastolic and end-systolic

D) Left Ventricular Function:

i. **LV Systolic Function:** measured by measuring left ventricular ejection fraction, circumferential shortening of the left ventricle, and cardiac output.

a. **Left Ventricular Ejection Fraction (LVEF):**
(LV Diastolic Volume – LV Systolic Volume)/ LV Diastolic Volume
LV diastolic volume and LV systolic volume were estimated by using the single-plane Simpson method in 2-D and by using the Teichoiz method in the M-mode study.

b. **Circumferential shortening of left Ventricular:** (LVIDd – LVIDs)/ LDIDd (LDIDd = Diastolic left

ventricle internal dimension and LVIDs = Systolic left ventricular internal dimension)

c. **Cardiac Output:**

i. **By Doppler Echocardiography:** By using the Doppler equation

C.O. = Cross-sectional area of aortic annulus xV.T.I.

= II R^2

= [] (½ D) ^{2} (D denotes the diameter of the aortic annulus).

ii. **by 2D- echocardiography-** By using Simpson's rule; C.O. = stroke volume x heart rate

iii. **LV diastolic function:** evaluated by measuring the Doppler flow across the mitral valve in apical chamber view and the following parameters were recorded.

- peak velocity E
- peak velocity A
- A/E
- Heart rate
- Mitral valve area
- stroke volume
- cardiac output

STATISTICAL ANALYSIS

- Data is described in terms of range, mean ±standard deviation (± SD), median, frequencies (number of cases), and relative frequencies (percentages) as appropriate.

- Comparison of quantitative variables between the study groups are performed using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data.

- For comparing categorical data: Chi-square ($\chi 2$) test is used, and exact test is used when the expected frequency was less than 5.
- A probability value (p-value) less than 0.05 will be considered statistically significant.
- All statistical calculations are done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

OBSERVATIONS & RESULTS

The present study was conducted to see the patterns of echocardiography findings and its correlation with age, duration of diabetes, obesity indices, HbA1c, and others anthropometric parameters. Observations are as following:

A. Sociodemographic Aspects:

Table 4: Distribution of Cases According to Sex		
SEX	**No. of Cases**	**Percentage**
M	206	68.7%
F	94	31.3%
Total	300	100.0%

In terms of gender, males showed more prevalence of LV dysfunction compared to females as shown in the table 4 and Figure 4.

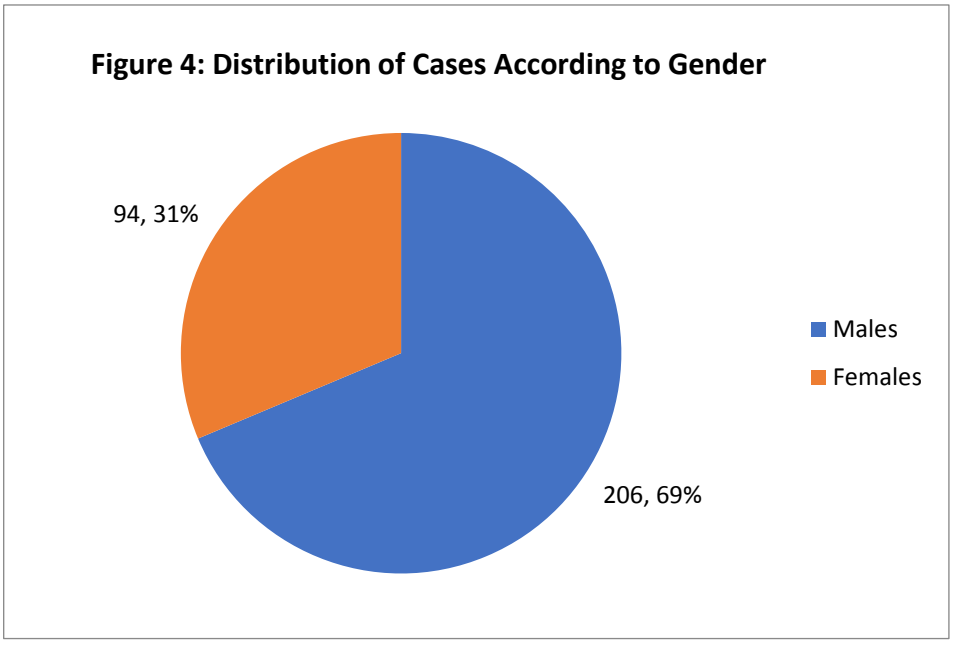


Table 5: Distribution of Patients According to Age		
AGE	**No. of Cases**	**Percentage**
< 50	59	19.7%
51-60	126	42.0%
>60	115	38.3%
Total	300	100.0%

The study contains majority of people from age group of 51-60 years old, followed by age group of > 60 years as illustrated in table 5 and Figure 5.

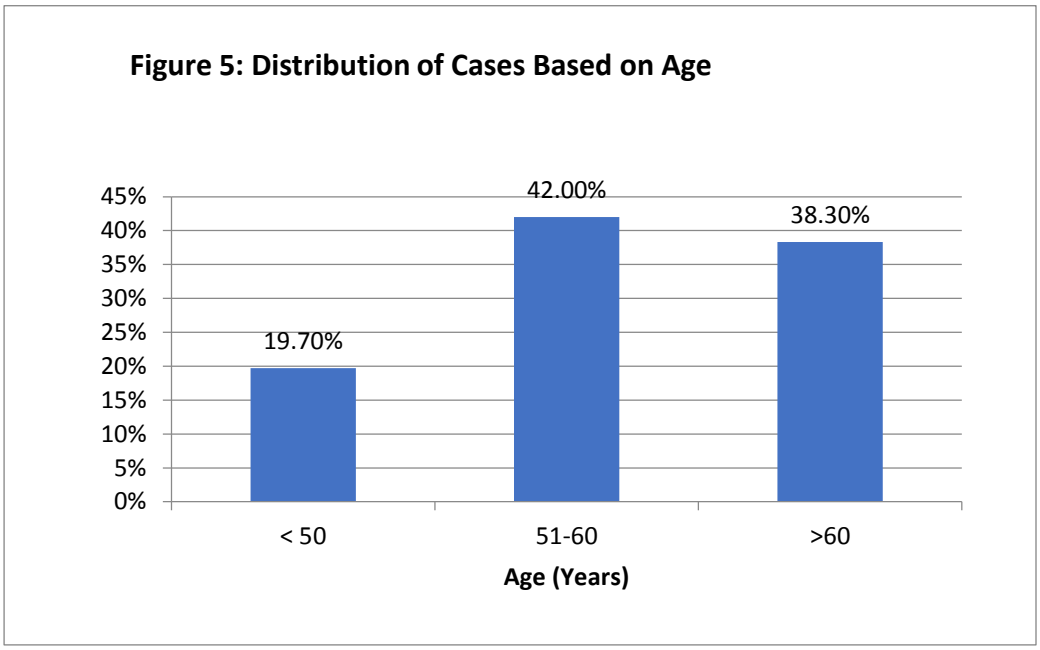


Table 6: Distribution of Cases According to BMI		
Body Mass Index (kg/m2)	No. of Cases	Percentage
Normal	85	28.3%
Overweight	94	31.3%
Obesity class I	101	33.7%
Obesity class II	18	6.0%
Obesity class III	2	0.7%
Total	300	100.0%

A significant number of cases were associated with obesity class I(33.7%), while obesity class II and III were at 6% and 0.7% respectively. 31.3% patients were overweight, placing them as secondly highest and 28.3% had BMI within normal limits as demonstrated in table 6 and Figure 6.

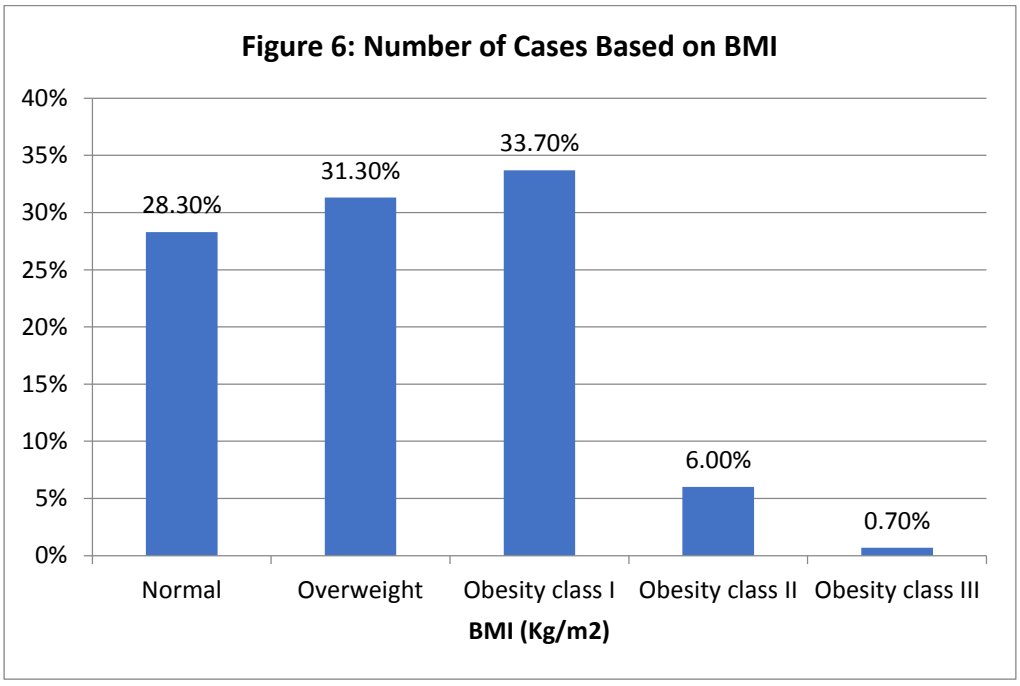


Table 7. Past History of Cases Enrolled		
PAST HISTORY	No. of Cases	Percentage
HYPERTENSION	34	11.3%
RENAL FAILURE	0	0.0%
CARDIAC DISEASE	0	0.0%
PULMONARY DISEASE	1	0.3%
THYROID DISORDER	**4**	1.3%
TUBERCULOSIS	2	0.7%
BRONCHIAL ASTHMA	1	0.3%
DIABETES MELLITUS	300	100.0%

The results showed that 11.3% cases were hypertensive with mean systolic BP of 124.20 ± 10.21 and diastolic BP of 78.98 ± 4.59, whereas only 4 cases had hypothyroidism and 2 cases with history of TB. More information is given in table 7 and Figure 7.

Figure 7: Past Medical Hisotry of Cases With Diabetes

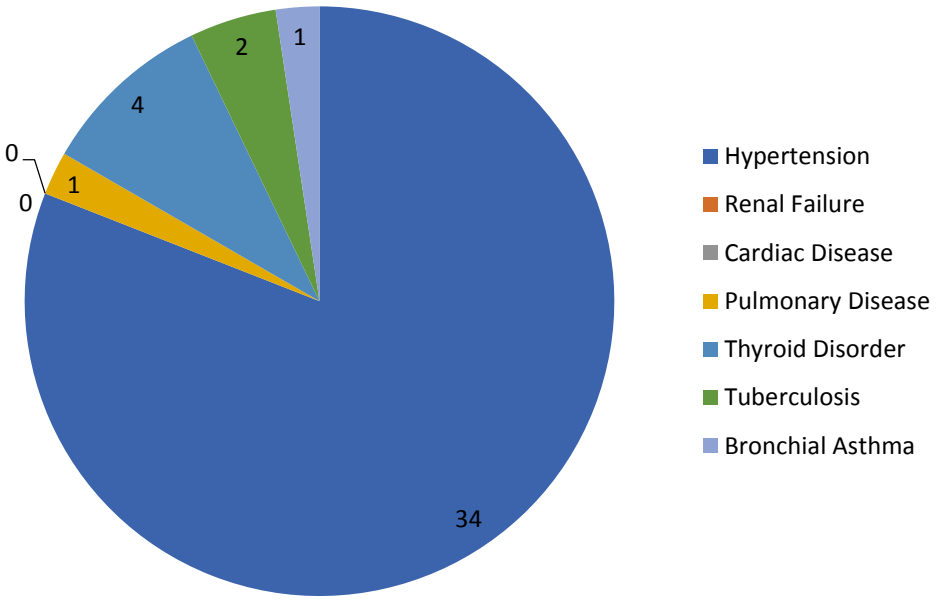


Table 8. Distribution of Cases According to Duration of Diabetes		
DM DURATION	No. of Cases	Percentage
< 10Y	196	65.3%
> 10Y	104	34.7%
Total	300	100.0%

The diabetes case patients were divided into two groups at shown in Figure8: first, 196 cases had diabetes for less than 10 years; second, the number of cases, who had diabetes for more than10 years were 104. The minimum duration of diabetes was 7 years while maximum was 36 years with mean of 11.29 ± 3.94.

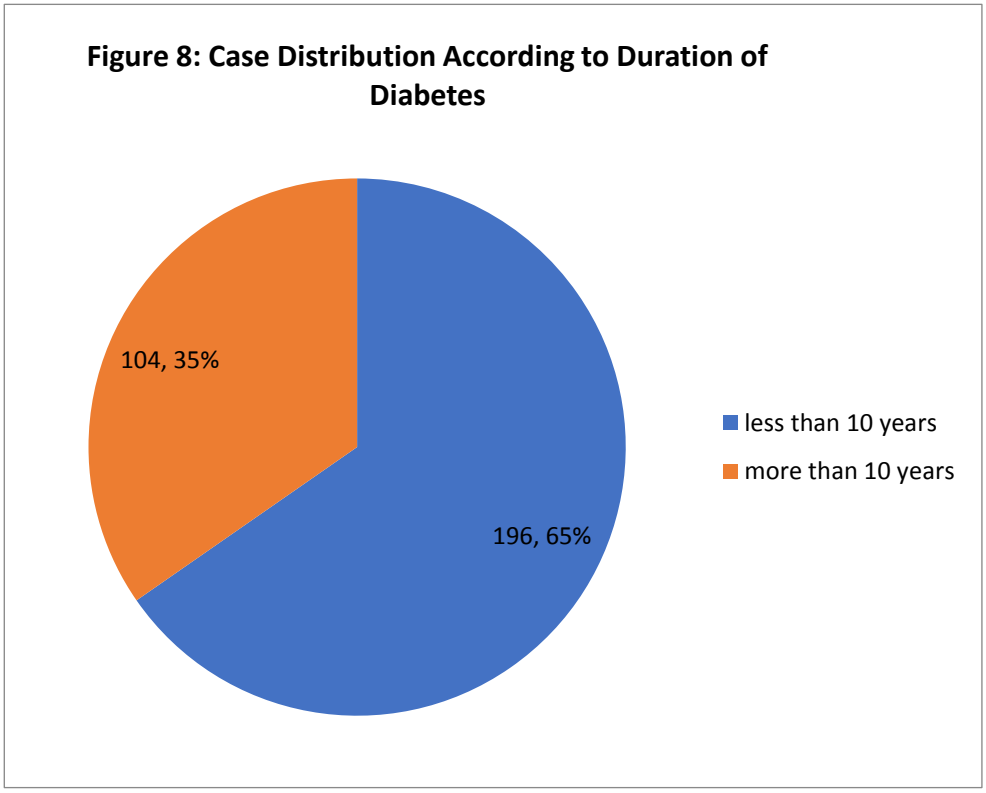
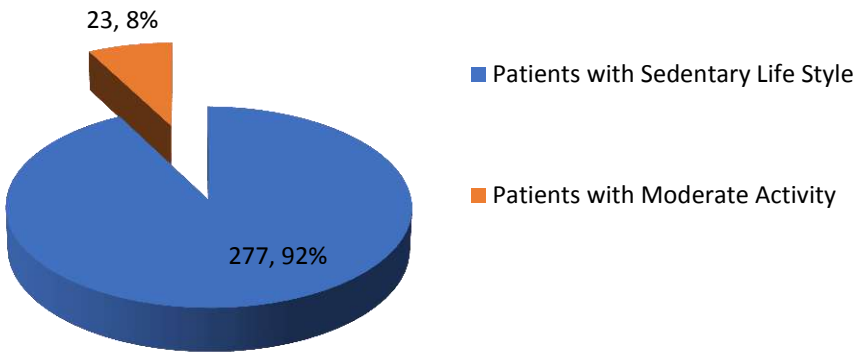


Table 9. Nature of Lifestyle of the Patients		
LIFE STYLE (SEDENTARY/ MODERATE ACTIVITY/ HEAVY PHYSICAL ACTIVITY)	No. of Cases	Percentage
SEDENTARY	277	92.3%
MODERATE ACTIVITY	23	7.7%%
Total	300	100.0%

The study showed majority of case patient were living a sedentary lifestyle at 92.3% (Figure 9). However, according to statistical analysis showed no effect of this parameter on the echocardiographic parameters in diabetic patients with p-value more than 0.05.

Figure 9: Lifestyle of the Patients



B. Physical parameters of heart:

Table 10. Aortic Root Group		
Aortic Root Group	No. of Cases	Percentage
High	87	29.0%
Normal	213	71.0%
Total	300	100%

According to study results, 29% of patients had increased aortic root dimensions on echocardiography as shown in the table 10 and Figure 10.

Figure 10: Aortic Root Dimensions

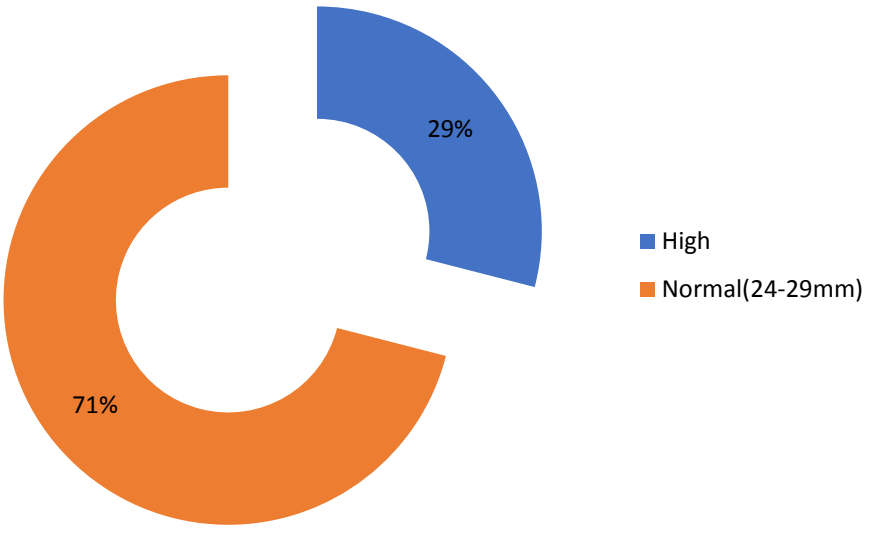
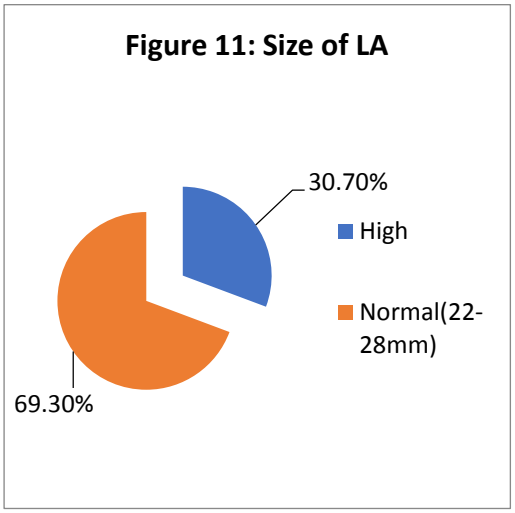


Table 11. Left Atrium Group		
Left Atrium Group	No. of Cases	Percentage
High	92	30.7%
Normal	208	69.3%
total	300	100%

Table 12. Right Atrium Group		
Right Atrium Group	No. of Cases	Percentage
Normal	270	90.0%
High	30	10.0%
Total	300	100%

The results showed that 1/3 of the cases had enlarged left atrium and only 10% had enlarged right atrium.



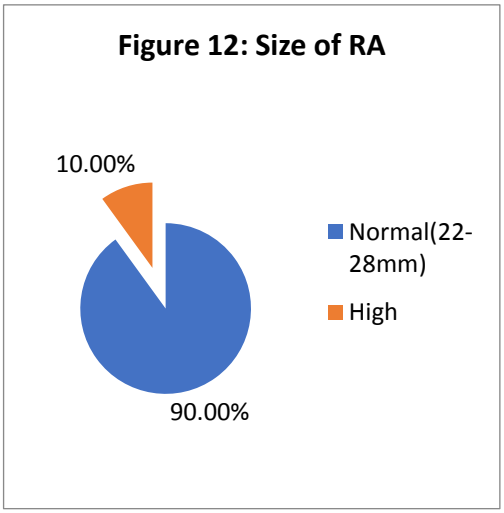


Table 13. Right Ventricular Internal Diameter (RVID) Group.		
RVID (D) Group	No. of Cases	Percentage
Normal	288	96.0%
High	12	4.0%
Total	300	100%

Right Ventricular Internal Diameter (RVID) was enlarged in only 4% of the patients as shown in Figure13 and table 13.

Figure 13: RVID

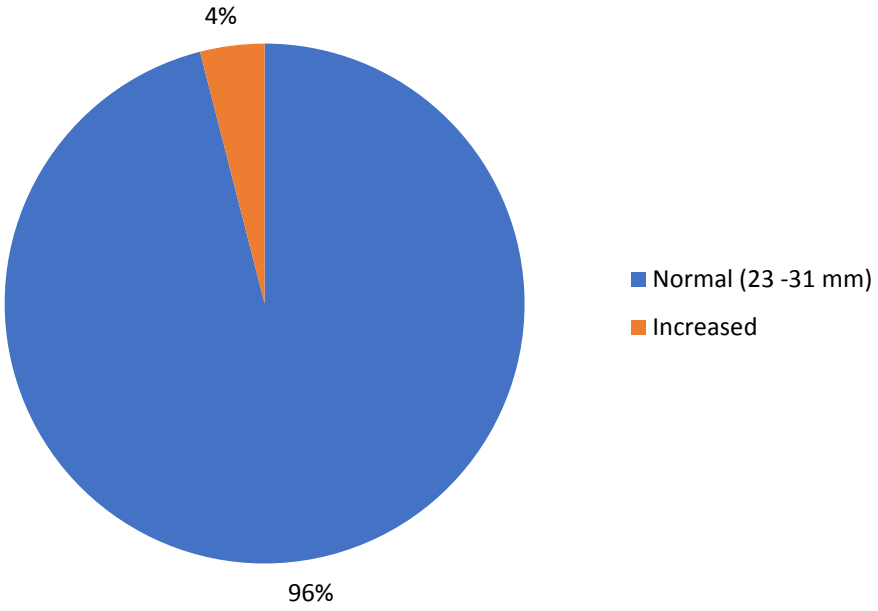


Table 14. Interventricular Septal Thickness (IVST) – Diastole Group		
IVST(D)	No. of Cases	Percentage
Normal	146	48.7.%
High	154	51.3%
Total	300	100%

Table 15. Interventricular Septal Thickness (IVST) – Systole Group		
IVST(S)	No. of Cases	Percentage
Normal	94	31.3.%
High	206	68.7%
Total	300	100%

In terms of Interventricular Septal Thickness (IVST), 8 patients had high IVST than normal during diastole. However, the difference was quite significant during systole, where 2 fold patients had high IVST than normal as illustrated in Figure 14 and table 14, 15.

Figure 14: Interventricular Septal Thickness (IVST)

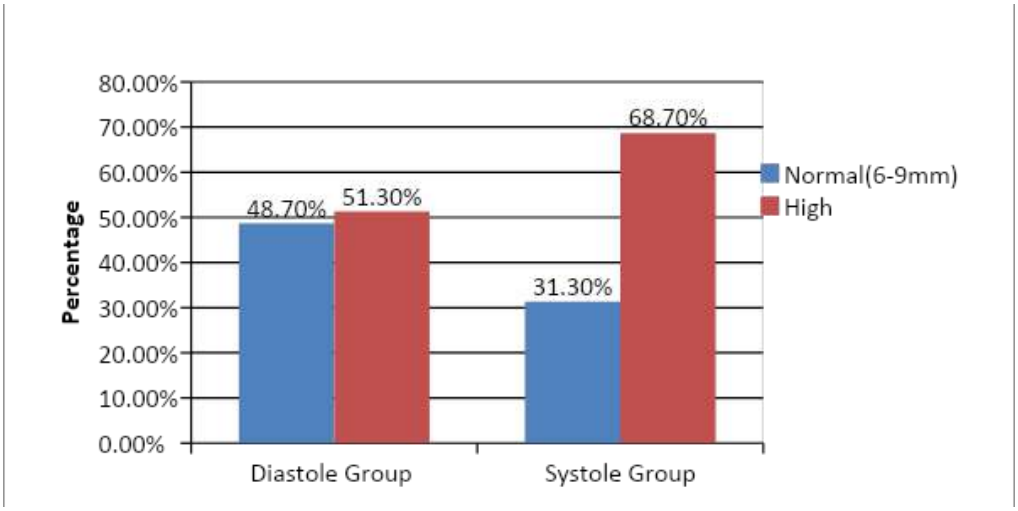


Table 16. Left Ventricular Internal Diameter (LVID) - Diastole Group		
LVID(D)	No. of Cases	Percentage
Normal	273	91.0.%
High	27	9.0%
Total	300	100%

Table 17. Left Ventricular Internal Diameter (LVID) - Systole Group		
LVID(S)	No. of Cases	Percentage
Normal	242	80.7.%
High	58	19.3%
Total	300	100%

Results shows that only 9% of patient had increased LVID during diastole while, approximately 19% of patients had high LVID during systole as shown in Figure 15 and table 16, 17.

Figure 15: LV Internal Diameter (LVID)

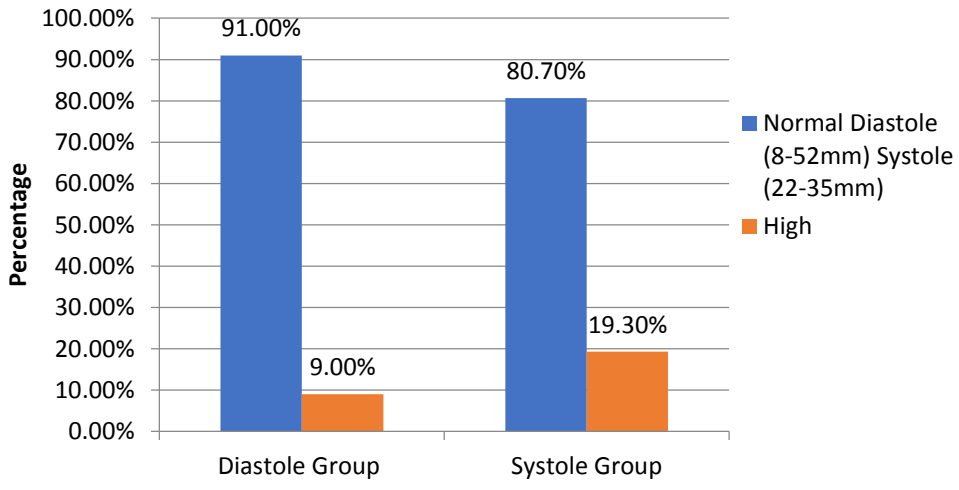


Table 18. Left Ventricular Posterior Wall (LVPWT) – Diastole Group		
LVPW(D)	No. of Cases	Percentage
Normal	162	54.0.%
High	138	46.0%
Total	300	100%

Table 19. . Left Ventricular Posterior Wall (LVPWT) - Systole Group		
LVPW(S)	No. of Cases	Percentage
Normal	76	25.3%
High	224	74.7%
Total	300	100%

Left ventricular posterior wall thickness was increased in 46% patients during diastole whereas the percentage of patients with increased LVPWT increased during systole to around 75% as shown in Figure16 and table 18,19.

Figure16: LV Posterior Wall Thickness

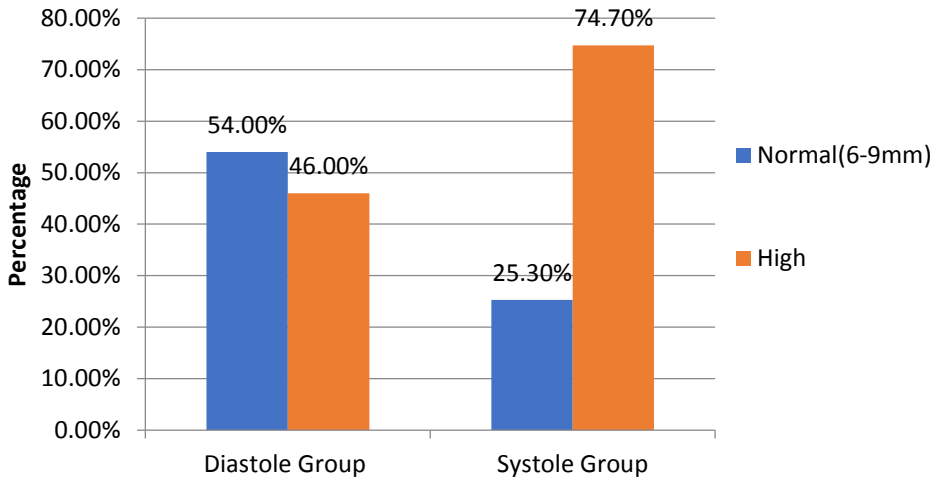


Table 20. Wall Motion Abnormalities in Study Group		
WMA	No. of Cases	percentage
GHK	16	5.3%
RWMA	69	23%
NO	215	71.7%
TOTAL	300	100.0%

In the present study, finding suggest that 16(5.3%) patients had global hypokinesia, and 69(23%) had regional wall motion abnormalities as shown in Figure17 and table 20.

Figure17: Wall Motion Changes

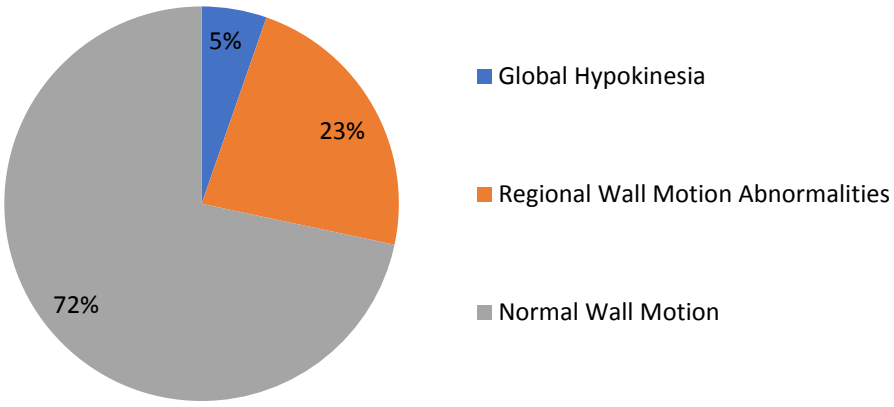


Table 21. Cardiac Chambers		
Cardiac Chambers	No. of Cases	Percentage
LVH	109	36.3%
LA-D	50	16.7%
LV-D	30	10.0%

With regards to cardiac chambers, 36.3% cases had left ventricular hypertrophy, 16.7% suggested left atrium dilation, 10% patients showed left ventricular dilation. This information is shown in the Figure18 and table 21.

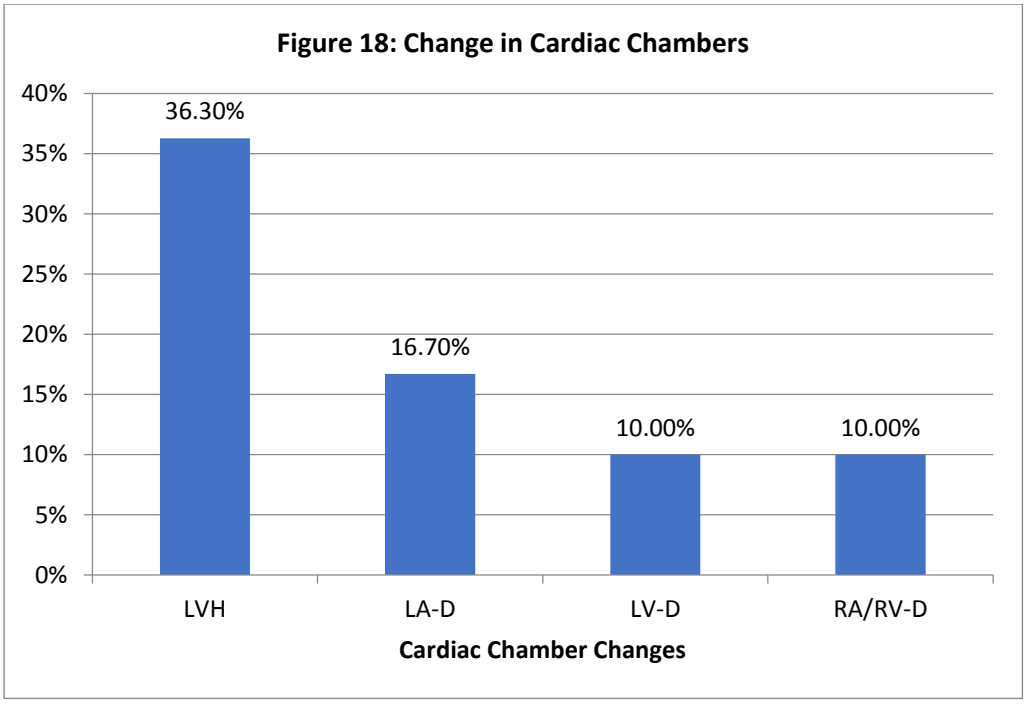


Table 22. Systolic Dysfunction		
SD	No. of Cases	Percentage
Grade I {40-49)	30	10%
Grade II (30-39)	42	14%
Grade III (<30)	10	3.3%
NO	218	72.7%
TOTAL	300	100.0%

Table 23. Diastolic Dysfunction		
DD	No. of Cases	Percentage
I	35	11.7%
II	36	12.0%
III	11	3.7%
IV	2	0.7%
NO	216	72.0%
Total	300	100.0%

Table 24. Overall Dysfunction Group		
Overall GROUP	No. of Cases	Percentage
NO	160	53.3%%
YES	140	46.7%%
Total	300	100.0%

Next three figures are demonstrating systolic dysfunction, diastolic dysfunction, and overall dysfunction. The study showed that 82(27.3%) patients had systolic dysfunction, 84(28.1%) patients had diastolic dysfunction, and 140 (46.7%) patients had both systolic and diastolic dysfunction as shown in Figure19,20,21 and table 22,23,24

Figure 19: Systolic Dysfunction

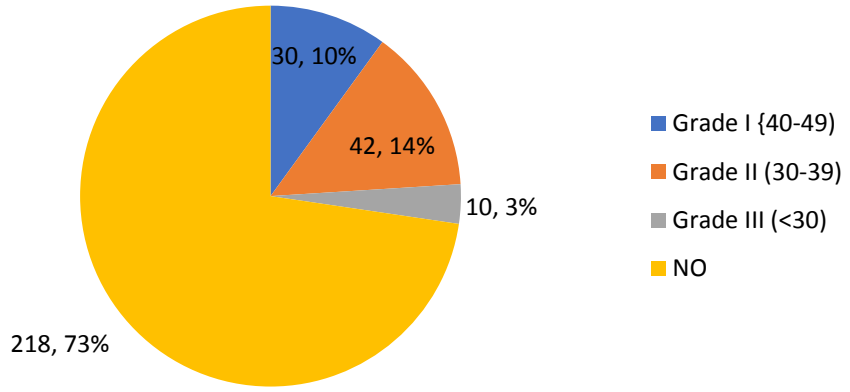


Figure 20: Diastolic Dysfunction

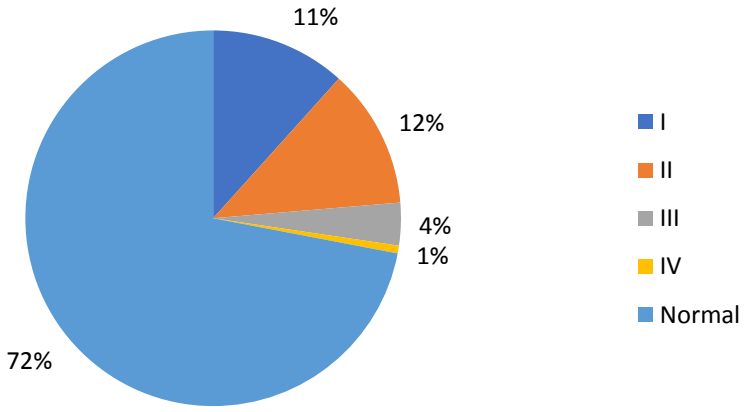


Figure 21: Both (Systolic and Diasytolic Dysfunction)

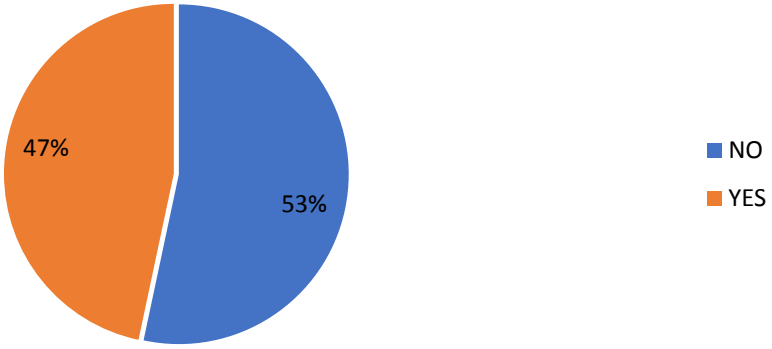


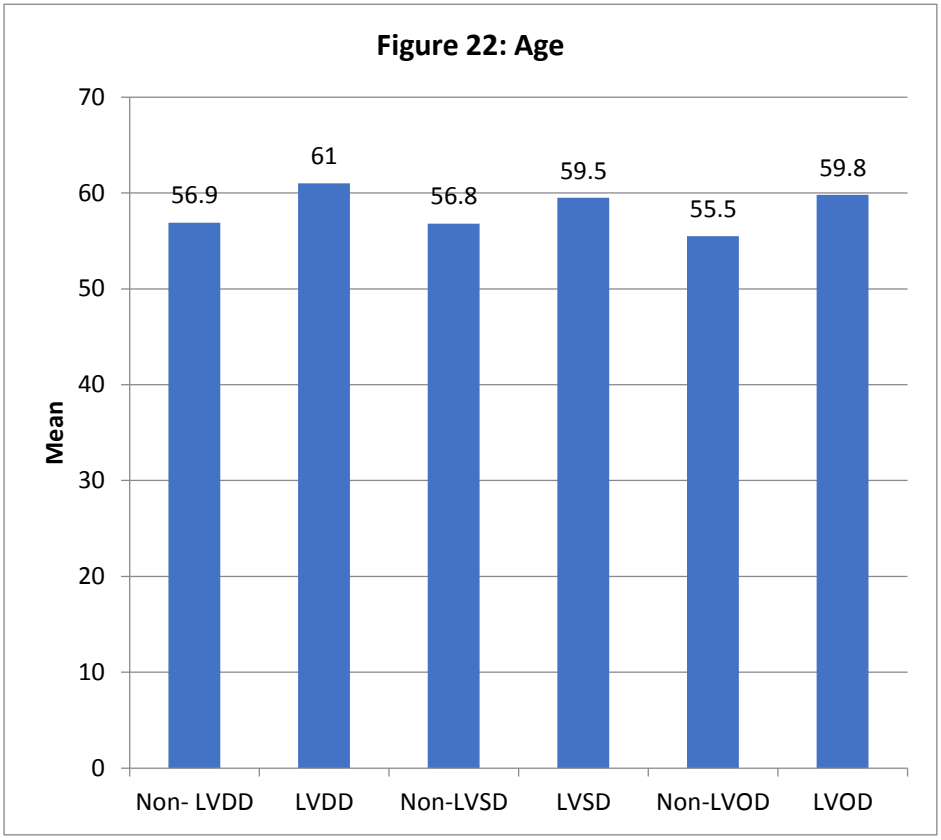
Table 25: Intergroup Data Extrapolation

Parameter	LVDD			LVSD			LVOD		
	Mean ± SD		P-value	Mean ± SD		P-value	Mean ± SD		P-value
	No	Yes		No	Yes		No	Yes	
Age	56.9±9.0	61.0±8.0	0.0**	56.8±8.2	59.5±10.6	0.02*	55.6±8.4	59.8±9.1	0.0**
Duration	11.4±4.1	10.7±3.3	0.2	11.2±3.8	11.5±4.3	0.54	11.4±4.1	11.2±3.7	0.6
SBP	123.5±8.3	125.9±13.7	0.06	124.3±11.2	123.7±6.6	0.60	123.4±8.9	125.1±11.4	0.2
DBP	78.8±4.4	79.4±4.9	0.3	78.8±4.8	79.2±3.6	0.56	78.7±4.6	79.2±4.5	0.4
Pulse	81.6±5.8	83.6±7.3	0.02*	82.3±6.9	81.8±4.4	0.56	81.7±6.4	82.7±6.2	0.2
BMI	27.4±3.9	30.7±3.5	0.0**	27.3±4.0	30.9±3.0	0.0**	26.1±3.3	30.9±3.3	0.0**
Waist Hip Ratio	0.9±0.1	1.0±0.1	0.0**	0.9±0.1	1.0±0.1	0.0**	0.9±0.1	1.0±0.1	0.0**
FBS	162.3±42.2	189.1±60.5	0.0**	163.8±45.2	186.0±56.2	0.0**	157.7±38.8	183.8±56.3	0.0**
HbA1c	8.6±2.0	9.5±1.9	0.01*	8.7±2.0	9.1±2.1	0.3	8.6±2	9.2±2.1	0.07

In the present study, important findings for diabetic patients in three categories (LVDD, LVSD, and LVOD) are as follows along with whether this statistical analysis is significant. This information is provided in table 25.

- Mean age in LVDD, LVSD, and LVOD were 61.02±8.00, 59.50±10.64, 59.83±9.11. This statistical analysis is highly significant ($p< 0.05$).
- Mean of duration of DM LVDD, LVSD, LVOD were 10.79±3.30, 11.52±4.30, 11.16±3.70. This statistical was found to be insignificant ($p>0.05$).
- Mean SBP/DBP in LVDD, LVSD, LVOD were 125.99±13.75/79.44±4.99,123.70±6.65/79.23±3.68, 125.10±11.44/79.24±4.51. There finding were not statistically significance ($p>0.05$).
- Heart rate only significant in LVDD with mean value of 83.62±7.38

- Mean BMI in LVDD, LVSD, LVOD were 30.76±3.58, 30.96±3.03, 30.90±3.34 respectively, and statistical analysis was highly significant (p< 0.05).
- Mean Waist hip ratio in LVDD, LVSD, LVOD were 1.02±0.1, 1.00±0.1, 1.01±0.1. Statistical analysis waist hip ratios were found to be highly significant (p<0.05).
- Mean values of Fasting blood sugar (FBS) in all three groups(LVDD, LVSD, LVOD) were 189.19±60.56, 186.00±56.25, 183.79±56.26. The statistical analysis was found to be highly significant.
- Glycosylated haemoglobin (HbA1c) on statistical analysis was significant (p <0.05) in LVDD group only.



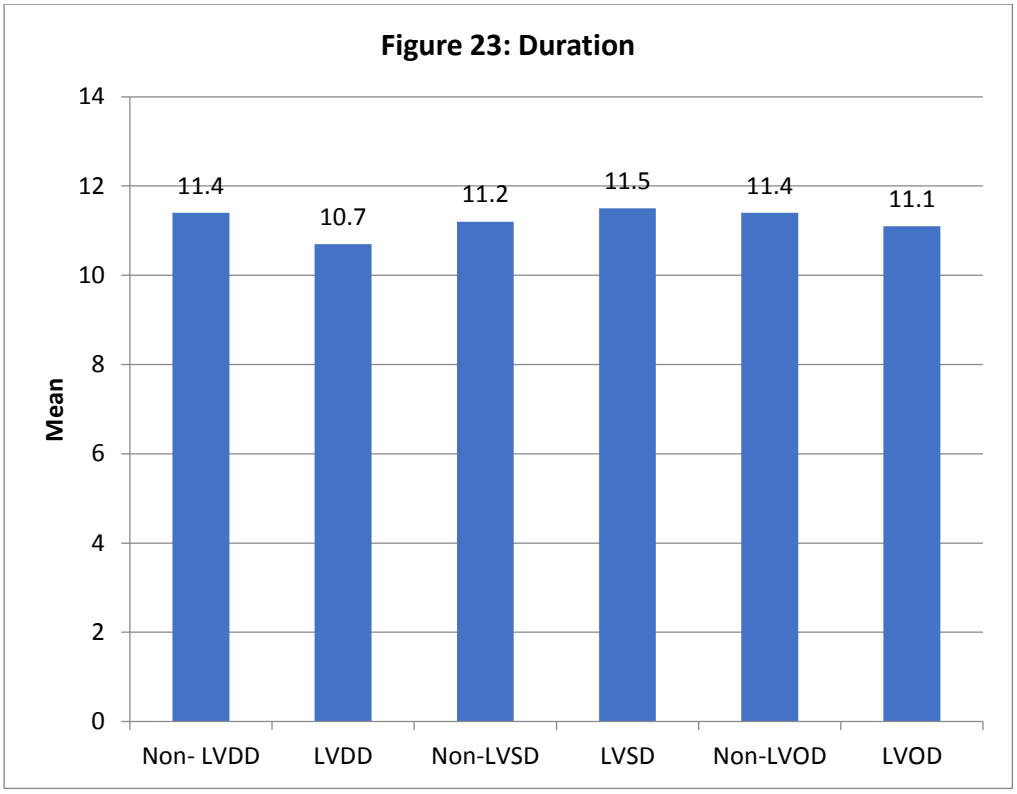


Figure 23: Duration
Mean
14
12
10
8
6
4
2
0
11.4
10.7
11.2
11.5
11.4
11.1
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD

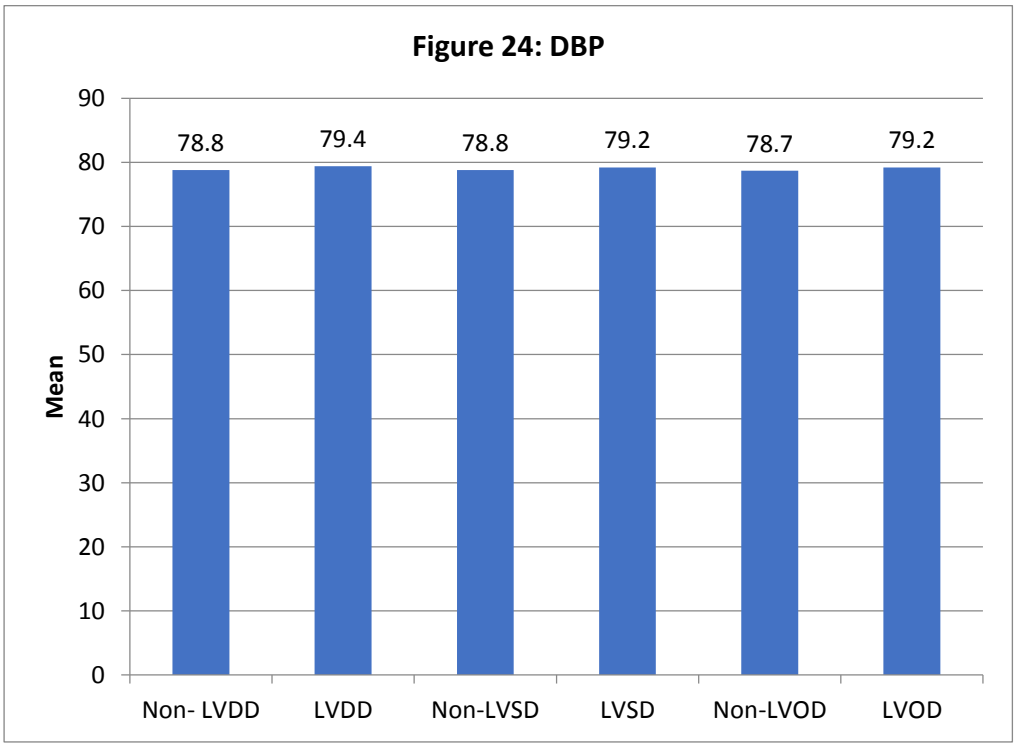


Figure 24: DBP
Mean
90
80
70
60
50
40
30
20
10
0
78.8
79.4
78.8
79.2
78.7
79.2
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD

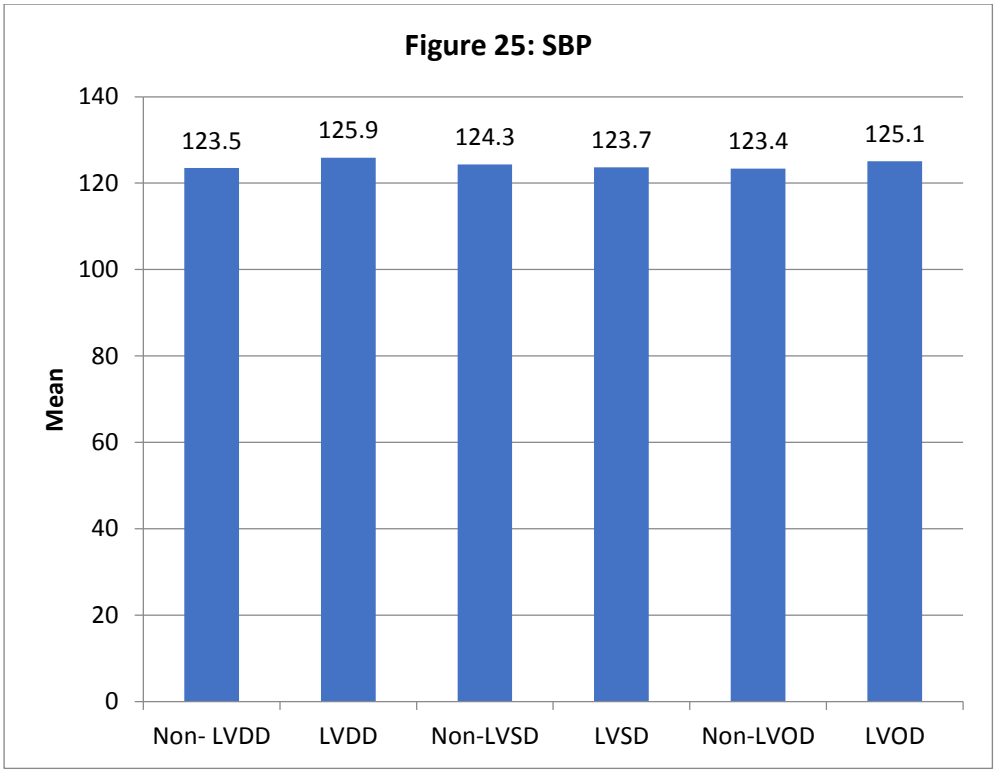


Figure 25: SBP
140
120
100
80
60
40
20
0
Mean
123.5
125.9
124.3
123.7
123.4
125.1
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD

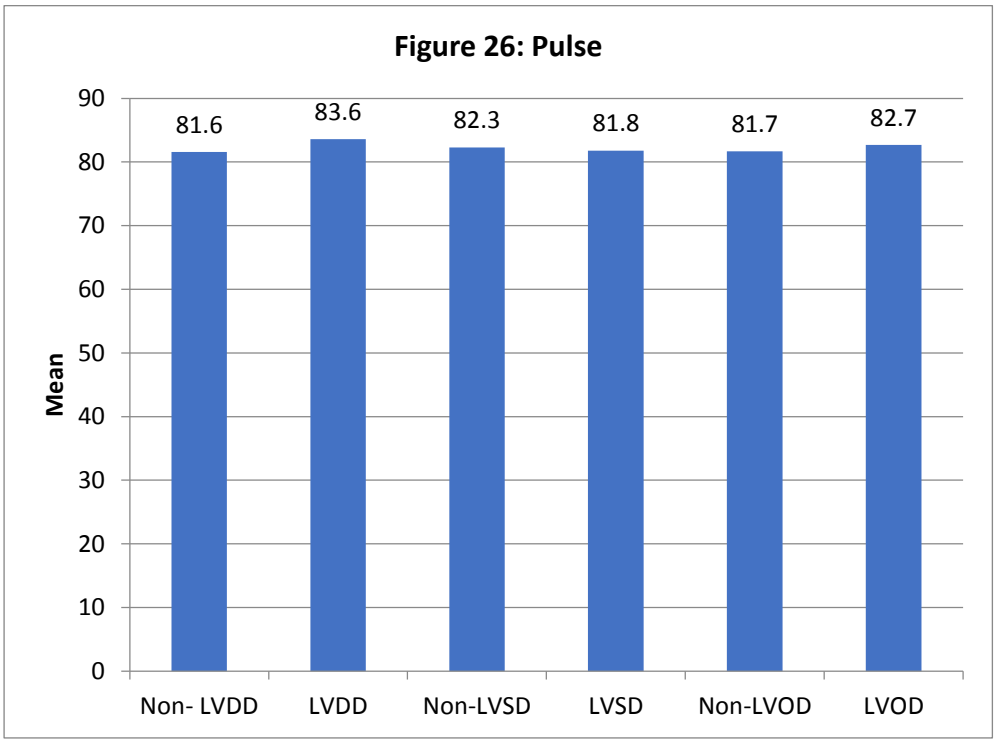


Figure 26: Pulse
90
80
70
60
50
40
30
20
10
0
Mean
81.6
83.6
82.3
81.8
81.7
82.7
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD

Figure 27: BMI

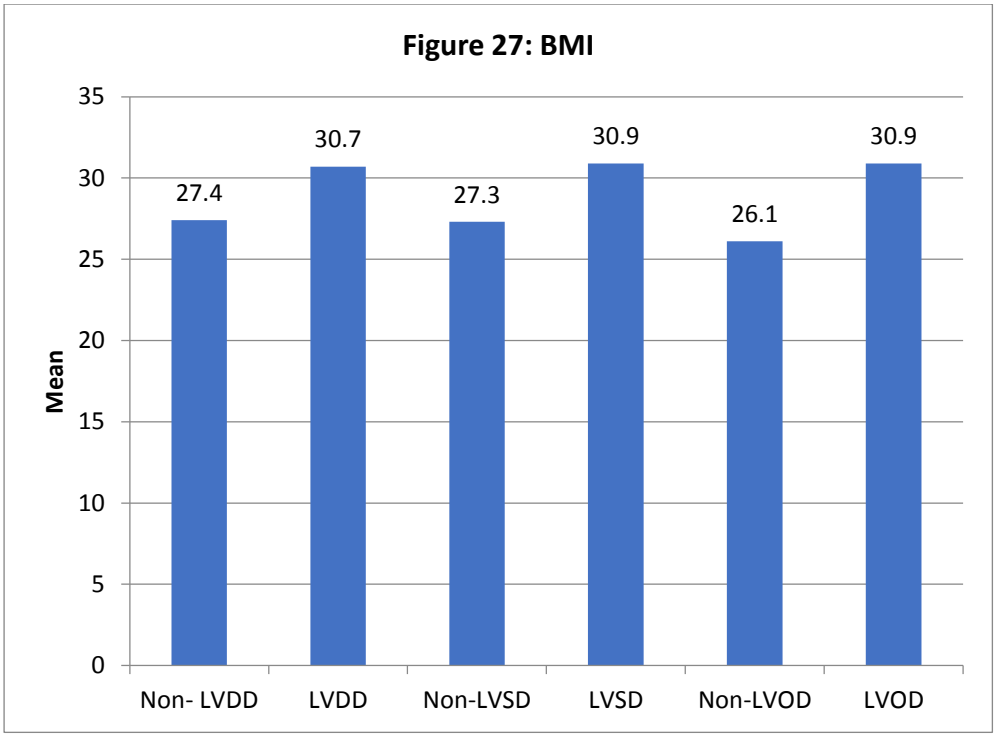
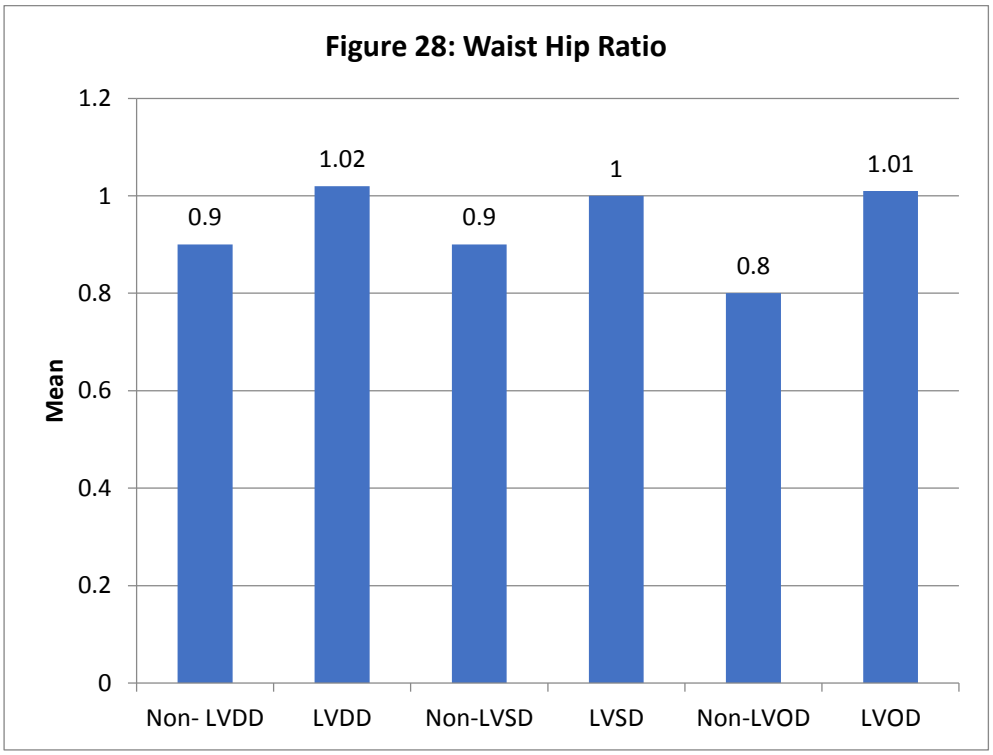


Figure 28: Waist Hip Ratio



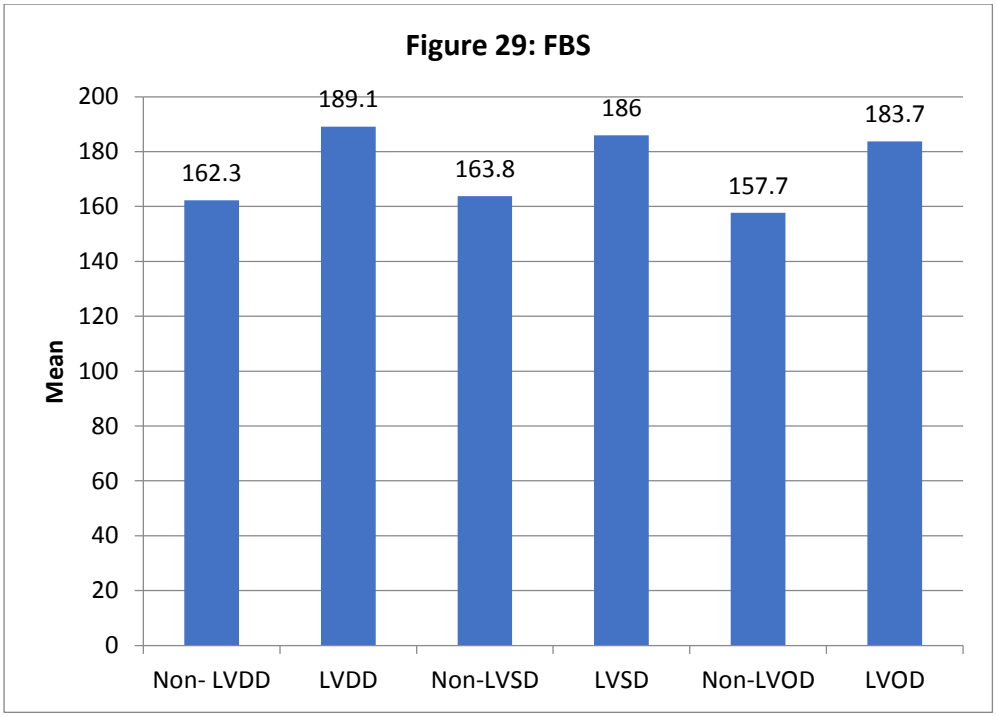


Figure 29: FBS
Mean
200
180
160
140
120
100
80
60
40
20
0
162.3
189.1
163.8
186
157.7
183.7
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD

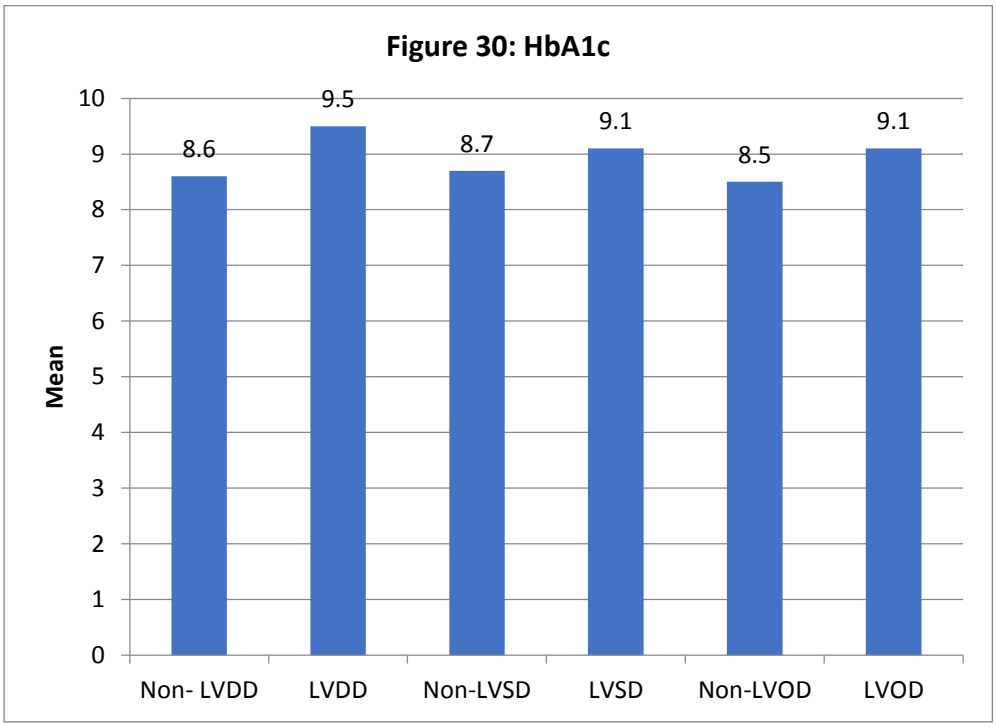


Figure 30: HbA1c
Mean
10
9
8
7
6
5
4
3
2
1
0
8.6
9.5
8.7
9.1
8.5
9.1
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD

Table 26: Echocardiographic Parameters

PARAMETER	LVDD			LVSD			LVOD		
	Mean ± SD		P value	Mean ± SD		P value	Mean ± SD		P value
	No	Yes		No	Yes		No	Yes	
Aortic root	28.3±3.3	28.1±3.7	0.66	28.3±3.6	28.3±2.9	0.9	28.3±3.4	28.2±3.5	0.83
Left atrium	35.8±4.9	39.3±5.7	0.0**	36.1±5.2	38.6±5.5	0.0**	35.2±4.7	38.5±5.6	0.0**
Rt. Atrium	20.8±3.2	21.7s±4.8	0.1	20.7±2.5	22.3±5.8	0.01*	20.6±2.2	21.7±4.9	0.01*
RVID (D)	22.4±2.8	22.9±3.7	0.2	22.1±1.4	23.7±5.1	0.0**	22.1±1.6	23.1±4.1	0.01*
IVST (D)	10.4±2.3	11.7±2.7	0.0**	11.0±2.3	10.0±2.6	0.0*	10.5±2,2	11.1±2.7	0.04*
IVST (S)	12.3±3.4	13.6±3.2	0.0*	13.1±3.5	11.6±2.9	0.01*	12.5±3.6	12.8±3.2	0.4
LVID (D)	46.6±7.5	47.9±8.1	0.2	44.5±5.5	53.5±8.7	0.0**	44.5±5.4	49.8±8.8	0.0**
LVID (S)	32.1±8.8	33.8±8.9	0.1	28.8±4.9	42.5±9.3	0.0**	28.5±5.1	37.2±9.9	0.0**
LVPW(D)	10.3±1.9	11.5±2.2	0.0**	11.0±1.8	9.6±2.4	0.0**	10.5±1.7	10.7±2.4	0.4
LVPW(S)	12.3±4.0	13.5±2.5	0.0**	12.1±3.9	11.6±2.8	0.005*	12.5±4.3	12.7±2.2	0.6
LVEF(%)	53.7±10.9	51.7±11.8	0.2	59.2±4.2	37.2±7.6	0.0**	59.5±3.4	45.9±12.5	0.0**
FS(%)	27.4±7.7	26.1±5.6	0.2	30.1±6.5	18.7±3.8	0.0**	29.7±1.9	23.1±6.1	0.0**
EDV	121.3±44.4	135.3±41.6	0.23	89.0±22.1	132.6±43.3	0.005*	86.4±24.8	131.3±43.0	0.01*
ESV	74.1±34.5	89.8±39.9	0.12	45.8±11.2	84.8±36.8	0.005*	45.8±13.2	83.4±36.9	0.01*
MV-E (VELO. GRAD)	77.5±21.5	86.3±27.0	0.01*	76.4±20.4	92.0±28.9	0.0**	74.9±19.3	86.2±26.6	0.001*
MV-A(VELO GRAD)	79.1±20.8	90.6±17.3	0.0**	82.3±18.6	83.8±26.5	0.7	78.9±18.8	87.0±21.6	0.008*
AV(VELO GRAD)	110.5±21.4	21.2±25.1	0.04*	114.8±23.1	107.6±20.5	0.2	110.9±21.5	116.5±23.9	0.25

Present study shows finding of echocardiographic finding in three different categories, LVDD,

LVSD, LVOD and suggest whether these finding are important as shown in table 26.

- Mean values of left atrium in LVDD, LVSD, LVOD were 39.3±5.7, 38.6±5.5, 38.5±5.6 respectively. They were highly

significant statistically ($p<0.05$).

- Statistical significant mean values for Right atrium in LVDD , LVSD, LVOD were 21.6±4.8, 22.3±5.8, 21.7±4.9.
- Statistical important mean values for Right ventricular internal diameter during diastole (RVIDd) in LVSD , LVOD groups were 23.77±5.14, 23.10±4.09
- Mean values for interventricular septal thickness during both systole and diastole in all three groups (LVDD = 13.6±3.3 and 11.7±2.7), (LVSD=11.6±2.9 and 10.0±2.6), (LVOD =12.86±3.18 and 11.1±2.7) were statistically significant ($p<0.05$).
- Mean values of Left ventricular internal diameter during diastole and systole in two groups, LVDD= 47.9±8.1 and 33.8±8.9, LVSD = 53.5±8.7 and 42.5±9.3; LVOD = 49.8±8.8 and 37.2±9.9) were statistically significant ($p<0.05$).
- Results showed that mean values of left ventricular posterior wall thickness during diastole and systole in LVDD and LVOD: 11.50±2.21 and 13.57±2.56, 9.61±2.42 and 11.63±2.79, respectively were statistically highly significant.

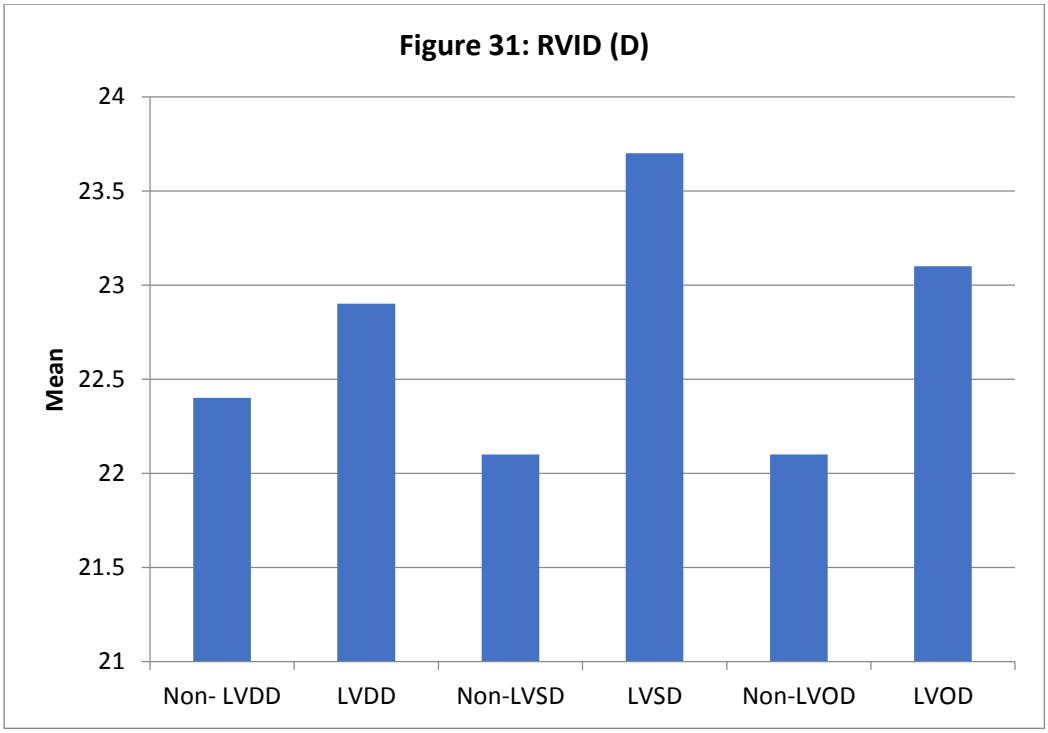


Figure 31: RVID (D)
Mean
24
23.5
23
22.5
22
21.5
21
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD

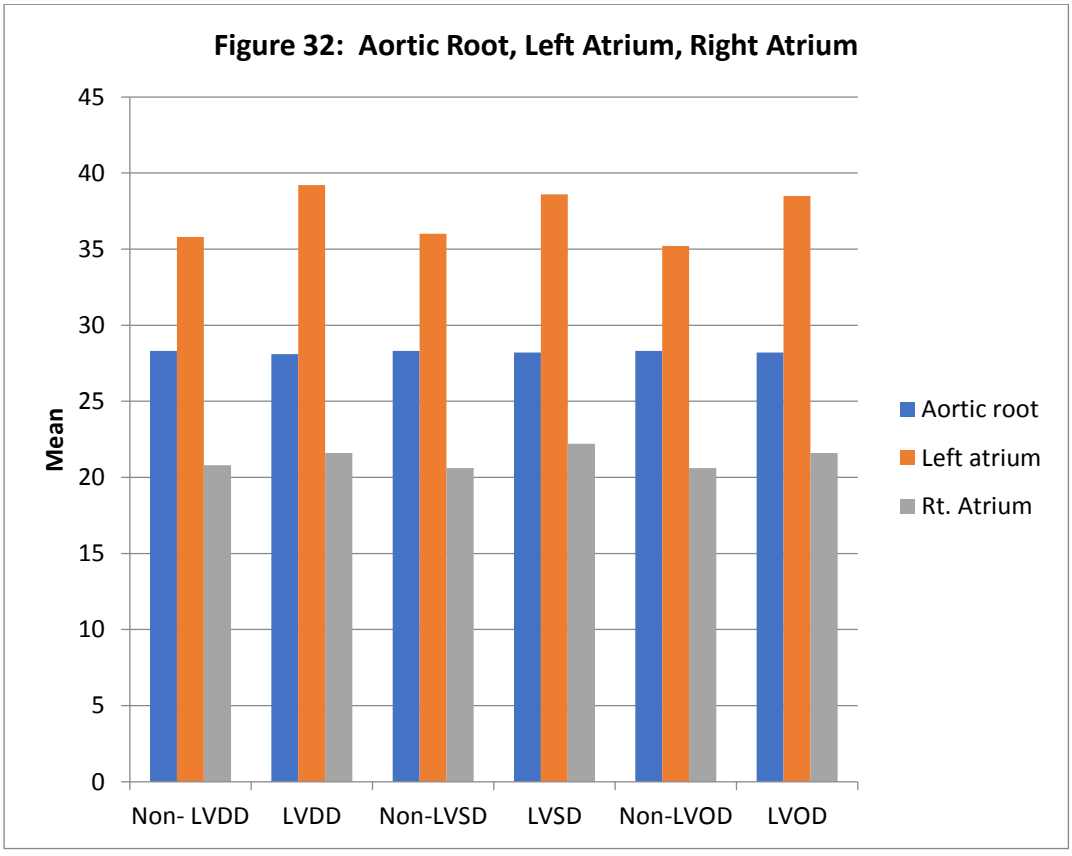


Figure 32: Aortic Root, Left Atrium, Right Atrium
Mean
45
40
35
30
25
20
15
10
5
0
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD
Aortic root
Left atrium
Rt. Atrium

Figure 33: IVST

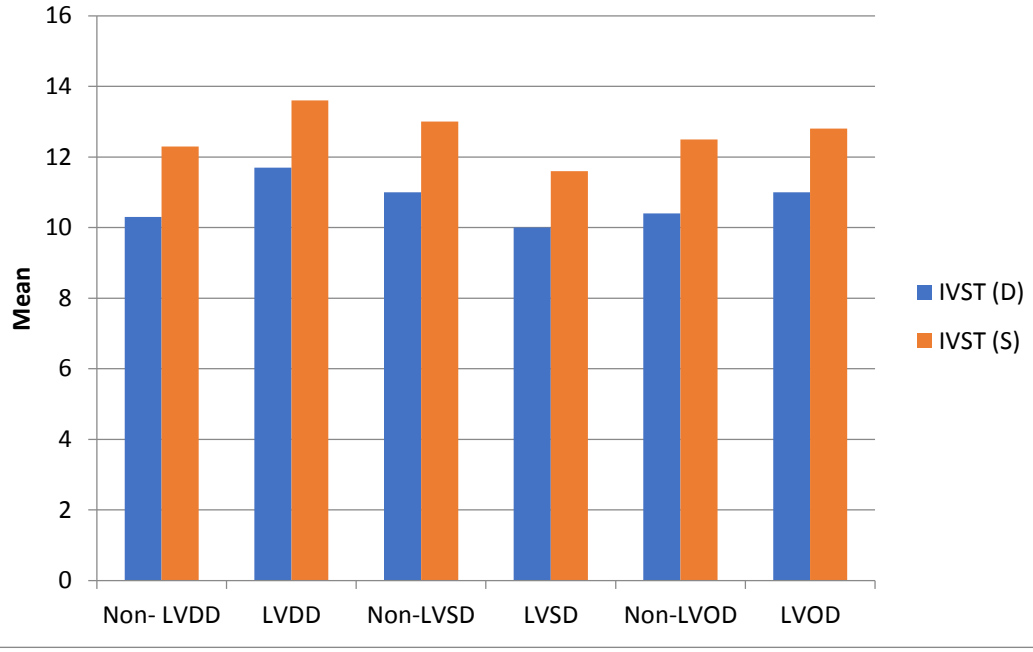


Figure 34: LVID

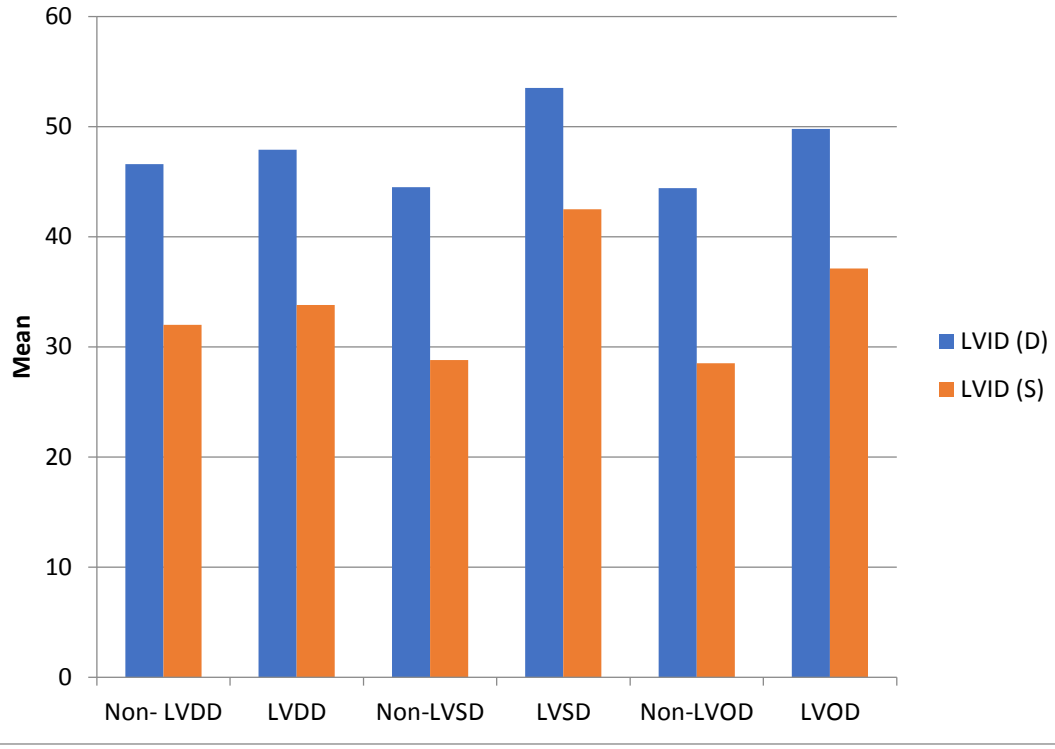


Figure 35: LVPW

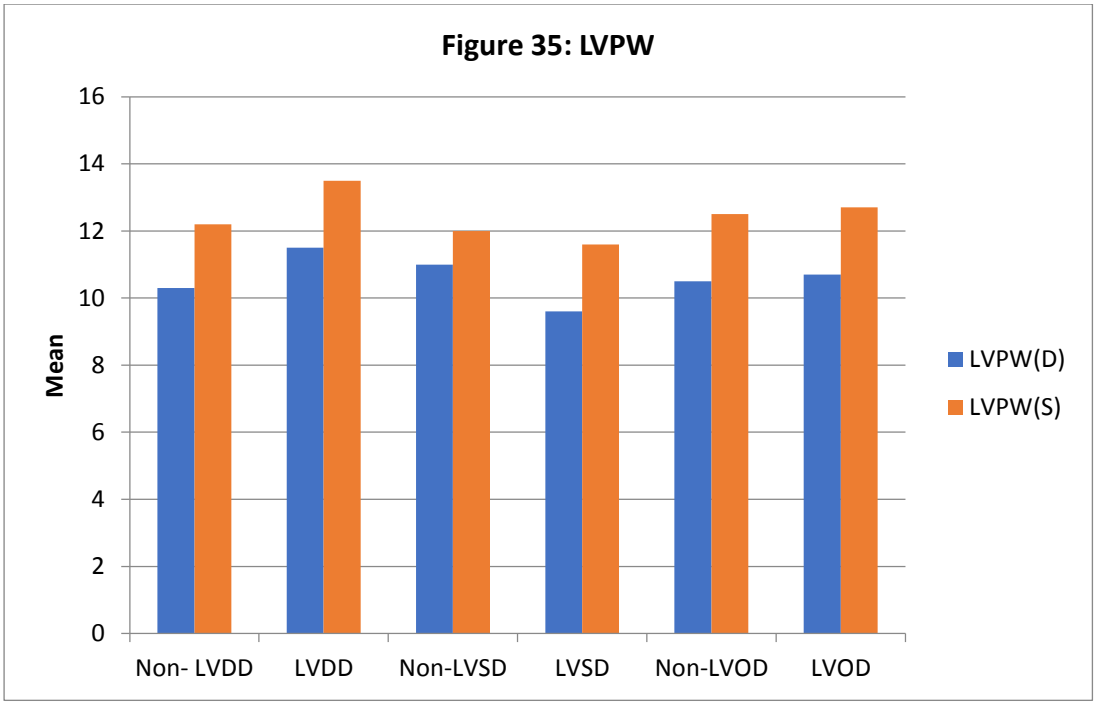
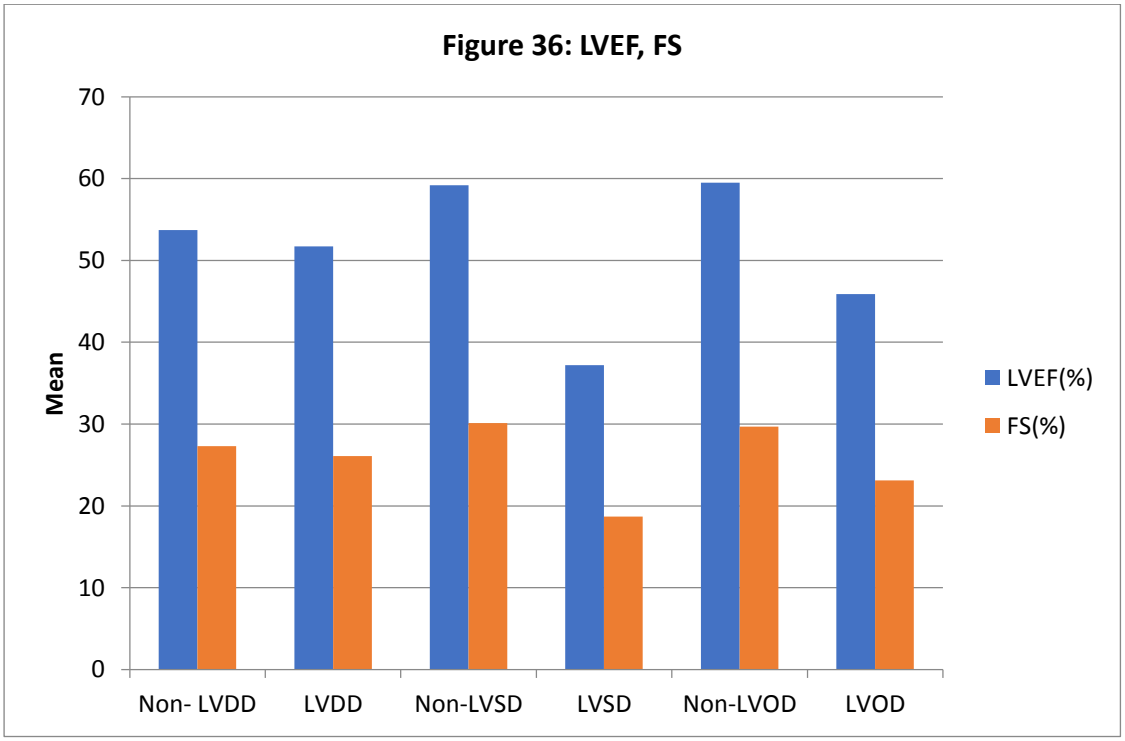


Figure 36: LVEF, FS



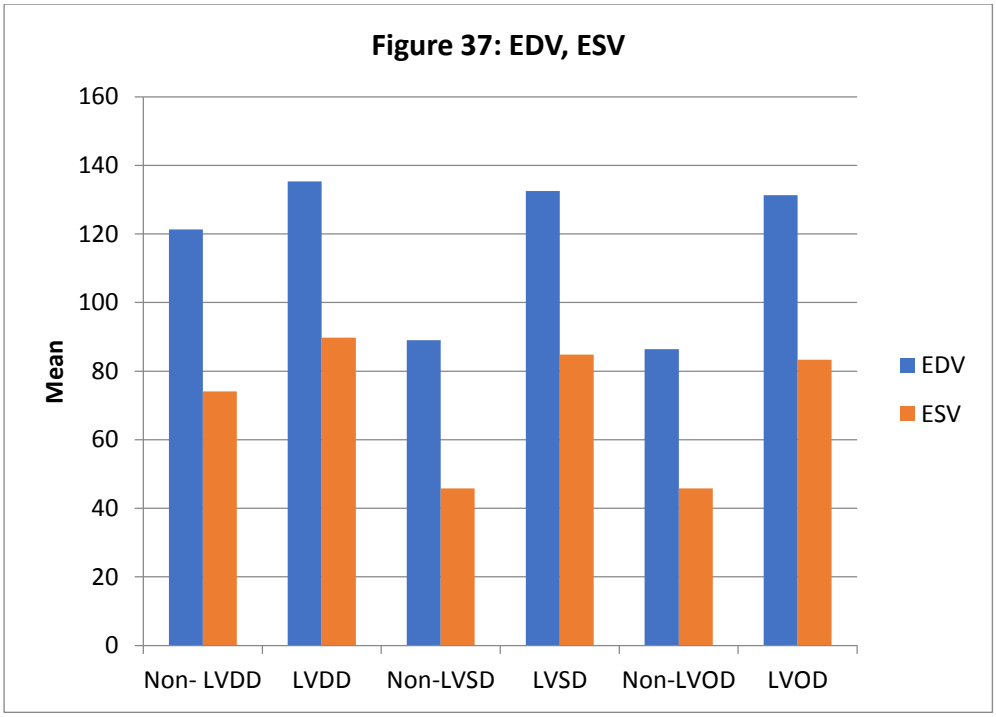


Figure 37: EDV, ESV
160
140
120
100
80
60
40
20
0
Mean
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD
EDV
ESV

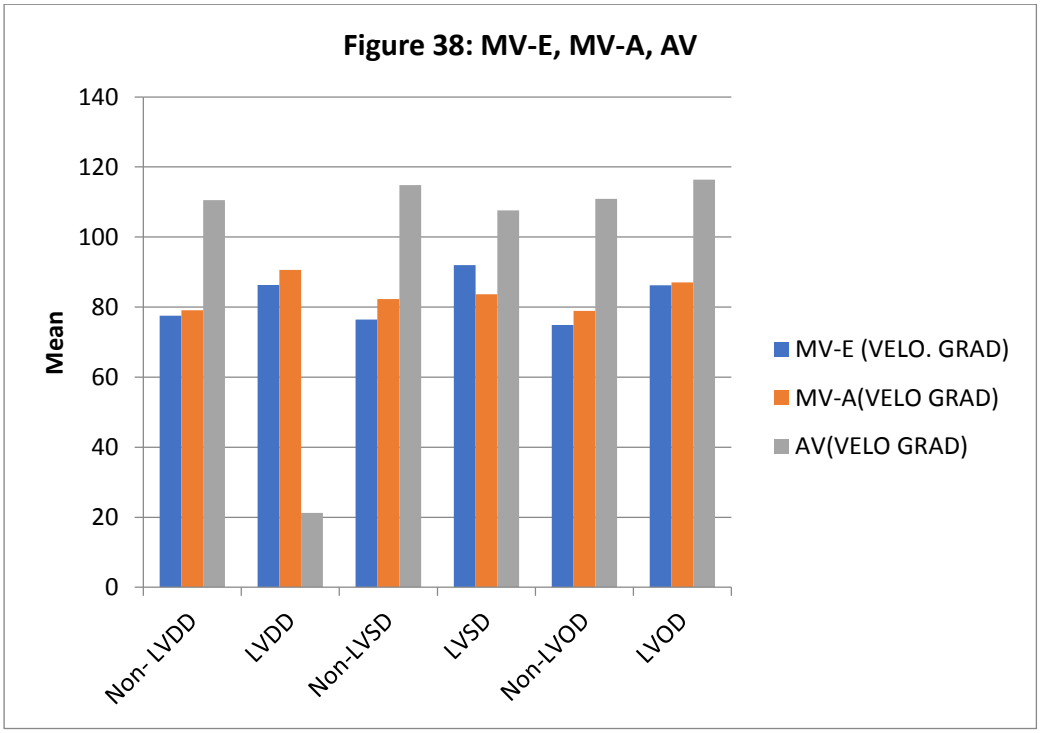


Figure 38: MV-E, MV-A, AV
140
120
100
80
60
40
20
0
Mean
Non- LVDD
LVDD
Non-LVSD
LVSD
Non-LVOD
LVOD
MV-E (VELO. GRAD)
MV-A(VELO GRAD)
AV(VELO GRAD)

Table No. 27 Multivariate Analysis

LVDD Group	p-value	Exp(B)	95% C.I.for EXP(B)	
			Lower	Upper
AGE	0.000	1.080	1.038	1.124
SEX(1)	0.450	0.765	0.382	1.532
LVH(1)	0.000	6.594	2.322	18.725
LA-D(1)	0.367	1.532	0.606	3.875
BODYMASSINDEXKGM2	0.000	1.215	1.110	1.330
FBS	0.006	1.009	1.002	1.015
LEFTATRIUM	0.072	1.076	0.994	1.166
RIGHTATRIUM	0.767	0.987	0.906	1.076
IVST(D)	0.913	1.009	0.864	1.177
LVPW(D)	0.561	0.936	0.750	1.169

Table No. 28 Multivariate Analysis

LVSD Group	p-value	Exp(B)	95% C.I.for EXP(B)	
			Lower	Upper
AGE	0.000	1.096	1.052	1.143
SEX(1)	0.311	0.681	0.324	1.432
LVH(1)	0.001	6.828	2.252	20.701
LVD(1)	0.691	1.261	0.402	3.952
BODYMASSINDEXKGM2	0.000	1.230	1.113	1.360
FBS	0.008	1.009	1.002	1.016
IVST(D)	0.093	1.441	0.941	2.208
IVST(S)	0.171	0.785	0.556	1.110
LVID(D)	0.457	1.039	0.939	1.149
LVID(S)	0.652	1.025	0.920	1.142
LVPW(D)	0.181	0.780	0.542	1.123
LVPW(S)	0.335	1.133	0.879	1.461
FS	0.081	1.064	0.992	1.140
LVFUNCTION_EFGROUP	0.189			
LVFUNCTION_EFGROUP(1)	0.297	0.240	0.016	3.515
LVFUNCTION_EFGROUP(2)	0.625	1.523	0.281	8.253
LVFUNCTION_EFGROUP(3)	0.431	0.540	0.117	2.501

Based on multivariate Analysis, the parameters such as age, BMI, LVH, FBS were statically significant (p-value <0.05) in both LVSD and LVDD group. However, other parameters such as gender, LAD, Atriums, IVSD, IVST, EF and so on were not significant.

DISCUSSION

In the present study, a well characterised diabetic population attending in and out patient department fulfilling the inclusion criteria were included in the study. All the patients underwent detailed clinical examination and only those who showed no clinical evidence of cardiovascular disease were eligible. Since coronary artery disease may be present in middle aged diabetic person and may affect the cardiac function, it was excluded by a negative history and normal resting electrocardiogram.

In the present study the mean heart rate in LVDD group was 83.6±7.3 as compared to LVSD group 81.8±4.4 p<0.016. *Uusitupa et al.* also found heart rate significantly higher in diabetics [69]. *Thomson et al.* Also, found heart rate to be 12 % higher in diabetic patients. Heart rate may be attributed to increased sympathetic activity or autonomic dysfunction.

Left ventricular volumes studied by 2D simpson single plane volume method did not show any significant difference in volumes during systole and diastole among diabetic patients. The abnormality in systolic function might have been due to asymptomatic coronary artery disease or uncontrolled hyperglycemia. Some authors have reported normalisation of systolic time interval after correction of hyperglycemia. Despite a normal or even increased myocardial systolic function at rest, an exercise induced ventricular dysfunction was frequently observed in the patients [89], [40], [72], [82].

Goldweit et al. found that in the diabetic patient without overt heart disease, variation on the blood glucose is related with small but significant variation in ejection fraction at rest. Normalisation of HbA1c has no significant effect on LVEF or the response of systolic function to blood glucose levels [115].

In the present study interventricular thickness was significantly more in all three groups which is in agreement to other studies[67][78]. Age may be contributory factor in increasing interventricular septal and left ventricular posterior wall thickness. The finding of an increased

interventricular septal thickness must be evaluated with caution. Since coronary artery disease can affect interventricular septal thickness. Coronary artery disease was excluded by a negative history, normal resting electrocardiogram. However coronary artery disease cannot be ruled definitely without coronary angiography, thus affecting the finding.

Gregor et al also found significantly increase in interventricular septal thickness and left ventricular posterior wall thickness [41].

Schmidt et al. also found increased posterior wall thickness and interventricular septal thickness in diabetics, thus providing evidence of an early structural change of myocardium in diabetic patients [116]. In young diabetic patients left ventricular mass was less as compared to healthy controls but in older diabetic patients left ventricular mass was significantly more as compared to healthy age matched controls. Increasing incidence of hypertension in older age group, more so in diabetic patients and age may be contributing factor in this finding.

Gregor et al. have found increased left ventricular mass in group of diabetic patients without coronary artery disease and hypertension[41]. *Airaksinen et al.* did not find difference in left ventricular mass in diabetics without microvascular complications, diabetes with severe microvascular complications and healthy controls [78].

Vanninen et al. also did not find significant difference in left ventricular mass in male diabetic patients as compared to controls but females diabetic patients had higher left ventricular mass as compared to female healthy controls [67]. Diabetic patients had reduced left ventricular end diastolic dimension. The left ventricular end diastolic dimension may be suggestive of restrictive pathology.

This study support the evidence that LV diastolic function may be impaired early in patients with diabetes mellitus (first 5 years from the diagnosis) before the development of symptomatic LV systolic and diastolic dysfunction and this seems to be comparable to previous reports.

In our study, we noted that there is direct relation between age and presence of diastolic dysfunction ($p<0.05$).The diastolic dysfunction in diabetics patients also correlated with the poor Glycemic control and HBa1c level which is comparable to the previous reports.

Hyperglycemia per se can lead to alteration in substrate supply and utilization by cardiac myocytes that represent the primary injury in the pathogenesis of diastolic dysfunction impairment and subsequently diabetic cardiomyopathy.

Celentano A et al.[117] reported that alteration in LV diastolic function seems to be related to level of fasting blood sugar and HbA1c even within normal limits and stating that each 1% increase in Hba1c level has been associated with an 8 % increase in the risk of heart failure [117-120] and HbA1c > 8 has also been associated with diastolic dysfunction[121], although the glycemic control may not reverse the diastolic dysfunction[122,123].

Importantly, improved glucose control may improve but no reverse diastolic impairment and a good glycemic control may decrease the risk of progression to overt heart failure.

In our study we found that 28% of asymptomatic diabetic patients have diastolic dysfunction which is comparable to the previous reports.

Patil et al.[124], in his study of 127 asymptomatic type II diabetics found a significant incidence (54.33%) of diastolic dysfunction in diabetics.

Van Heerebeek et al.[125] in his study found that the cardiomyocyte resting tension is more important when LVEF is normal and excessive diastolic LV stiffness is an important mechanism to heart failure in diabetic patients.

Sohail et al.[104] reported that 30.7% of patients with type II diabetes mellitus had LV diastolic dysfunction.

In the current study, most of patients with diastolic dysfunction (11.7%) had impaired LV relaxation (grade I), 12.0% had a pseudonormal filling pattern (grade II) which is compared to *Zabalgoitia et al.* study who reported that diastolic dysfunction was found in 47%

of diabetic patients, 30% had impaired relaxation and 17% had a pseudonormal filling pattern. 3.7% patient in our study had a restrictive filling pattern (grade III). *Xiara et al* [98]reported in their study that 63.2% of diabetic patients had LV diastolic dysfunction, 77.4% of them had impaired relaxation pattern, 22.6% had pseudonormal pattern and no one had restrictive pattern of diastolic dysfunction.

Much effort was made to propose satisfactory diagnostic criteria for LV diastolic dysfunction with numerous echocardiographic parameters that are highly influenced by changes in volume status, blood pressure, and heart rate that causing difficulty in their interpretation in diabetic patients.

The "gold standard" procedure for assessing LV diastolic function is "Cardiac catheterization with simultaneous pressure and volume measurements, but it is invasive procedure and usually cannot be performed in the many patients".

During the last two decades, Doppler echocardiography together with more recently developed myocardial tissue Doppler imaging has emerged as an important non-invasive technique for the assessment of LV diastolic function.

In the current study we applied the last AHA and ESC guideline [126] in the assessment of LV diastolic function which depend mainly on the parameters of TDI in addition to LA volume index and peak TR velocity. Using these parameters seems to increase the rate of detection of diastolic dysfunction. These new techniques help as to overcome some technical limitations in the conventional Doppler echocardiographic techniques of diastolic function. The existence of the pseudonormal LV filling pattern (grade II) diastolic dysfunction was not evaluated in most of the earlier reports. Therefore it is possible that many patients with diastolic dysfunction with a pseudonormal pattern would not have missed this diagnosis if these new techniques had been performed. This is may be the cause for the discrepancies in the prevalence of diastolic dysfunction that was noted between earlier and resent studies.

Boyer et al. detected "LV filling impairment in 46% in asymptomatic normotensive Type 2 diabetic patients when screened by conventional Doppler, whilst newer techniques showed diastolic dysfunction in 75% of patients"[108].

"Ommen et al. [127] in their study found that the ratio of mitral velocity to early diastolic velocity of the mitral annulus (E/e) is better correlated with LV filling pressures than other Doppler parameters.

In the present study impaired diastolic function was not associated with the duration of diabetes or the presence of microangiopathy. Many study have not found any relation of diastolic dysfunction with the duration of diabetes or presence of microangiopathy [69][13][63][70]. In some echocardiographic studies, the duration of diabetes and microvascular complications were associated with LV diastolic performance [75][91].

Although mean heart rate was significantly higher in diabetics. There was no clinical evidence of autonomic neuropathy in diabetic patients in the present study. The difference in rate does not appear to explain the difference in mitral inflow velocity, as the velocity of early relaxation has been shown to be independent of cycle length and heart rate.

Thus the end diastolic abnormalities may be as a result of abnormal ventricular relaxation or decreased ventricular compliance. The abnormal ventricular relaxation may be because of abnormality of calcium transport in the sarcoplasm reticulum [96]. Necropsy studies and experimental evidence from alloxan induced diabetic dogs have shown that diabetes may also be associated with accumulation of collagen and glycoprotein in the interstitium of myocardium resulting in myocardium restriction [46][50][52]. Diabetic patients with severe microvascular complications have small vessel disease of coronary circulation analogous to that in the retina and kidney. Microangiopathy may induce diffuse myocardial ischemia with resultant interstitial fibrosis and decreased LV compliance[128][44].

Other cardiac abnormalities in patients with Type 2 diabetes

Left ventricular hypertrophy is a well-established precursor both of systolic dysfunction[129] and overall cardiovascular disease [130][131]. Though typically associated with hypertension and its prevalence increases with increasing age, body mass index and presence of hypertension and diabetes[132] all the characteristics of a population of outpatients with type 2 diabetes. Hence, left ventricular hypertrophy is a very relevant concern in this population, and in accordance, we found a prevalence of 36.3%. However, further research is needed to determine the isolated effect of diabetes in this population.

Left atrial enlargement reflects elevated left ventricular filling pressures in the ailing heart and is associated with stroke and mortality in the general population, patients with myocardial infarction and ischaemic cardiomyopathy[133][134][135]. Of note, *Poulsen et al*.[136] recently found that left atrial enlargement is associated with a composite endpoint of all-cause mortality and cardiovascular events in patients with Type 2 diabetes.

The systolic function was assessed by fractional shortening (FS) and EF. It is within reduced limits in LVSD & LVOD group with mean of 18.7±3.8&23.1±6.1 shown high statistical significance. ($p<0.05$)

SUMMARY & CONCLUSION

1. Left ventricular systolic and diastolic is a common cardiac disorder in patients with type 2 DM without associated risk factors.
2. Doppler evaluation of diastolic function may offer a more sensitive, non-invasive way to evaluate subclinical cardiac dysfunction in diabetic patients.
3. Age, BMI, Waist hip ratio, FBS, HbA1c are significant factor for the development of LVDD and LVSD.
4. Diastolic dysfunction in diabetic patients is independent of duration of diabetes .
5. Early diagnosis and institution of treatment with ACE inhibitors, angiotensin II receptor blockers, aldosterone antagonists, and diuretics will reduce the morbidity and improve the outcome of diastolic heart failure.
6. Patients with Type 2 DM should be screened for subclinical LVDD by echocardiography regardless of cardiac symptoms and clinical characteristics.
7. Long term serial follow up studies are necessary to determine whether subclinical diastolic abnormalities in diabetic patients progress to clinically evident heart disease or are additive in those who develop subsequent ischemic cardiac disease.

LIMITATION OF THE STUDY

1. This is a cross-sectional observational study so follow-up of the progression of the subtle LV diastolic abnormalities detected in this study would have added important information to the development of cardiac complications and congestive heart failure in diabetic patients
2. Asymptomatic coronary heart disease may be present in middle aged person, particularly in diabetic patients. Inspite of absence of symptoms, normal resting EKG and absence of cardiac asynergy on two dimensional echocardiography, coronary artery disease could not be excluded completely and may influence results in the present study.

REFERENCES

1. Omran AR. The epidemiologic transition: a theory of the epidemiology of population change. 1971. Milbank Q. 2005;83:731-57.
2. World Health Organization. Noncommunicable Diseases Progress Monitor 2015. World Health Organization; 2015 p. 232.
3. Chen S, Kuhn M, Prettner K, Bloom DE. The macroeconomic burden of non-communicable diseases in the United States: Estimates and projections. PLoS One. 2018;13:e0206702
4. International Diabetes Federation. Diabetes facts & figures. Available from: https://www.idf.org/aboutdiabetes/what-is-diabetes/facts-figures.html#:~:text=Diabetes%20facts%20%26%20figures,-Last%20update%3A%2012&text=In%202019%2C,low%2D%20and%20middle%2Dincome%20countries (12/2/2020)
5. Poznyak A, Grechko AV, Poggio P, Myasoedova VA, Alfieri V, Orekhov AN. The Diabetes Mellitus-Atherosclerosis Connection: The Role of Lipid and Glucose Metabolism and Chronic Inflammation. Int J Mol Sci. 2020;21:1835.
6. Nag T, Ghosh A. Cardiovascular disease risk factors in Asian Indian population: A systematic review. J Cardiovasc Dis Res. 2013;4:222-8.
7. Chandalia M, Abate N, Garg A, Stray-Gundersen J, Grundy SM. Relationship between generalized and upper body obesity to insulin resistance in Asian Indian men. J Clin Endocrinol Metab. 1999;84:2329-35.
8. Misra A, Vikram NK. Insulin resistance syndrome (metabolic syndrome) and obesity in Asian Indians: evidence and implications. Nutrition. 2004;20:482-91.
9. Martín-Timón I, Sevillano-Collantes C, Segura-Galindo A, Del Cañizo-Gómez FJ. Type 2 diabetes and cardiovascular disease: Have all risk factors the same strength? World J Diabetes. 2014;5:444-70.

10. Sherwani SI, Khan HA, Ekhzaimy A, Masood A, Sakharkar MK. Significance of HbA1c Test in Diagnosis and Prognosis of Diabetic Patients. Biomark Insights. 2016;11:95-104.
11. Draman MS, Thabit H, Kiernan TJ, O'Neill J, Sreenan S, McDermott JH. A silent myocardial infarction in the diabetes outpatient clinic: case report and review of the literature. Endocrinol Diabetes Metab Case Rep. 2013;2013:130058.
12. Rutter MK, Parise H, Benjamin EJ, Levy D, Larson MG, Meigs JB, Nesto RW, Wilson PW, Vasan RS. Impact of glucose intolerance and insulin resistance on cardiac structure and function: sex-related differences in the Framingham Heart Study. Circulation. 2003;107:448-54.
13. Shapiro LM. Echocardiographic features of impaired ventricular function in diabetes mellitus. Br Heart J. 1982;47:439-44.
14. MacCracken J, Hoel D. From ants to analogues. Puzzles and promises in diabetes management. Postgrad Med. 1997;101:138-50.
15. Frank LL. Diabetes mellitus in the texts of old Hindu medicine (Charaka, Susruta, Vagbhata). Am J Gastroenterol.1957;27:76-95.
16. Nazimek-Siewniak B, Moczulski D, Grzeszczak W. Risk of macrovascular and microvascular complications in Type 2 diabetes: results of longitudinal study design. J Diabetes Complications. 2002;16:271-6.
17. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2009;32:S62-S67.
18. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med. 2006;3:e442.
19. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27:1047-53.
20. Joshi SR, Parikh RM. India--diabetes capital of the world: now heading towards hypertension. J Assoc Physicians India. 2007;55:323-4.

21. Ojha A, Ojha U, Mohammed R, Chandrashekar A, Ojha H. Current perspective on the role of insulin and glucagon in the pathogenesis and treatment of type 2 diabetes mellitus. Clin Pharmacol. 2019;11:57-65.
22. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care.1997;20:1183-97.
23. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. Diabet Med. 1998;15:539-53.
24. Iqbal A, Hussain A, Iqbal A, Kumar V. Correlation Between Vitamin D Deficiency and Diabetic Ketoacidosis. Cureus. 2019;11:e4497.
25. Turner RC, Cull CA, Frighi V, Holman RR. Glycemic control with diet, sulfonylurea, metformin, or insulin in patients with type 2 diabetes mellitus: progressive requirement for multiple therapies (UKPDS 49). UK Prospective Diabetes Study (UKPDS) Group. JAMA. 1999;281:2005-12.
26. Gujral UP, Pradeepa R, Weber MB, Narayan KM, Mohan V. Type 2 diabetes in South Asians: similarities and differences with white Caucasian and other populations. Ann N Y Acad Sci. 2013;1281:51-63.
27. Lyssenko V, Laakso M. Genetic screening for the risk of type 2 diabetes: worthless or valuable? Diabetes Care. 2013;36:S120-6.
28. Davey G, Ramachandran A, Snehalatha C, Hitman GA, McKeigue PM. Familial aggregation of central obesity in Southern Indians. Int J Obes Relat Metab Disord.2000 Nov;24:1523-7.
29. Stratton IM, Adler AI, Neil HAW, Matthews DR, Manley SE, Cull CA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): Prospective observational study. Br Med J. 2000;321:405–12.
30. Carr AA, Kowey PR, Devereux RB, Brenner BM, Dahlöf B, Ibsen H, Lindholm LH, Lyle PA, Snapinn SM, Zhang Z, Edelman JM,

Shahinfar S. Hospitalizations for new heart failure among subjects with diabetes mellitus in the RENAAL and LIFE studies. Am J Cardiol. 2005;96:1530-6.

31. Yancy CW, Jessup M, Bozkurt B, Butler J, Casey DE Jr, Drazner MH, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. Circulation. 2013;128:e240-327.
32. Liu Q, Wang S, Cai L. Diabetic cardiomyopathy and its mechanisms: Role of oxidative stress and damage. J Diabetes Investig. 2014;5:623-34.
33. Boudina S, Abel ED. Diabetic cardiomyopathy revisited. Circulation. 2007;115:3213-23.
34. Miki T, Yuda S, Kouzu H, Miura T. Diabetic cardiomyopathy: pathophysiology and clinical features. Heart Fail Rev. 2013;18:149-66.
35. Jia G, DeMarco VG, Sowers JR. Insulin resistance and hyperinsulinaemia in diabetic cardiomyopathy. Nat Rev Endocrinol. 2016;12:144-53.
36. Wang Y, Negishi T, Negishi K, Marwick TH. Prediction of heart failure in patients with type 2 diabetes mellitus- a systematic review and meta-analysis. Diabetes Res Clin Pract. 2015;108:55-66.
37. Cardiovascular Disease and Diabetes | American Heart Association [Internet]. [cited 2020 Nov 28]. Available from: https://www.heart.org/en/health-topics/diabetes/why-diabetes-matters/cardiovascular-disease--diabetes (last review 30-aug-2015)
38. Wang Y, Negishi T, Negishi K, Marwick TH. Prediction of heart failure in patients with type 2 diabetes mellitus-A systematic review and meta-analysis. Diabetes Res Clin Pract. 2015;108:55–66.

39. Edmonds ME, Blundell MP, Morris ME, Thomas EM, Cotton LT, Watkins PJ. Improved survival of the diabetic foot: the role of a specialized foot clinic. Q J Med. 1986;60:763-71.
40. Lehtinen JM, Uusitupa M, Siitonen O, Pyörälä K. Prevalence of neuropathy in newly diagnosed NIDDM and nondiabetic control subjects. Diabetes. 1989;38:1307-13.
41. Wiley Online Library. Ledet T. DIABETIC CARDIOPATHY. Acta Pathol Microbiol Scand Sect A Pathol. 2009;84A:421–8.
42. Gregor P, Widimsky P, Rostlapil J, Cervenka V, Visek V. Echocardiographic picture in diabetes mellitus. Jpn Heart J. 1984;25:969-77.
43. Laakso M, Rönnemaa T, Pyörälä K, Kallio V, Puukka P, Penttilä I. Atherosclerotic vascular disease and its risk factors in non-insulin-dependent diabetic and nondiabetic subjects in Finland. Diabetes Care. 1988;11:449-63.
44. Paz-Guevara AT, Hsu TH, White P. Juvenile diabetes mellitus after forty years. Diabetes. 1975;24:559-65.
45. Factor SM, Okun EM, Minase T. Capillary microaneurysms in the human diabetic heart. N Engl J Med. 1980;302:384-8.
46. McMillan DE. Deterioration of the microcirculation in diabetes. Diabetes. 1975;24:944-57.
47. Moore GW, Hutchins GM, Bulkley BH, Tseng JS, Ki PF. Constituents of the human ventricular myocardium: connective tissue hyperplasia accompanying muscular hypertrophy. Am Heart J. 1980;100:610-6.
48. Gøtzsche O. Myocardial cell dysfunction in diabetes mellitus. A review of clinical and experimental studies. Diabetes. 1986;35:1158-62.
49. Williams RS, Schaible TF, Scheuer J, Kennedy R. Effects of experimental diabetes on adrenergic and cholinergic receptors of rat myocardium. Diabetes. 1983;32:881-6.
50. Ledet T. Histological and histochemical changes in the coronary arteries of old diabetic patients. Diabetologia. 1968;4:268-72.

51. Nunoda S, Genda A, Sugihara N, Nakayama A, Mizuno S, Takeda R. Quantitative approach to the histopathology of the biopsied right ventricular myocardium in patients with diabetes mellitus. Heart Vessels. 1985:43-7.
52. Regan TJ, Lyons MM, Ahmed SS, Levinson GE, Oldewurtel HA, Ahmad MR, et al. Evidence for cardiomyopathy in familial diabetes mellitus. J Clin Invest. 1977 ;60:884-99.
53. Edler I, Hertz CH. The use of ultrasonic reflectoscope for the continuous recording of the movements of heart walls. 1954. Clin Physiol Funct Imaging. 2004;24:118-36.
54. Feigenbaum H, Zaky A, Waldhausen JA. Use of ultrasound in the diagnosis of pericardial effusion. Ann Intern Med. 1966;65:443-52.
55. Popp RL, Wolfe SB, Hirata T, Feigenbaum H. Estimation of right and left ventricular size by ultrasound: A study of the echoes from the interventricular septum. The American journal of cardiology.1969;24:523-30.
56. Gramiak R, Shah PM, Kramer DH. Ultrasound cardiography: contrast studies in anatomy and function. Radiology. 1969;92939-48.
57. Feigenbaum H, Stone JM, Lee DA, Nasser WK, Chang S. Identification of ultrasound echoes from the left ventricle by use of intracardiac injections of indocyanine green. Circulation.1970;41615-21.
58. Sahn DJ, DeMaria AN, Kisslo JO, Weyman AF. Recommendations regarding quantitation in M-mode echocardiography: results of a survey of echocardiographic measurements. Circulation.1978;58:1072-83.
59. Cooper RH, O'Rourke RA, Karliner JS, Peterson KL, Leopold GR. Comparison of ultrasound and cineangiographic measurements of the mean rate of circumferential fiber shortening in man. Circulation. 1971;46:914-23.
60. TROY BL, Pombo J, Rackley CE. Measurement of left ventricular wall thickness and mass by echocardiography. Circulation.1972;45:602-11.

61. Trivedi SK, Gupta OP, Jain AP, Jajoo UN, Kamble AN, Bharambhe MS. Left ventricular mass in normal Indian population. Indian Heart J.1991;43:155-9.
62. Kounis NG, Zavras GM, Soufras GD, Kitrou M. Systolic and diastolic septal and posterior wall echocardiographic measurements in normal subjects. Angiology.1989;40:521-6.
63. Robson SC, Murray A, Peart I, Heads A, Hunter S. Reproducibility of cardiac output measurement by cross sectional and Doppler echocardiography. Heart.1988;59:680-4.
64. Gibson DG, Brown DJ. Measurement of instantaneous left ventricular dimension and filling rate in man, using echocardiography. British heart journal. 1973;35:1141.
65. Spirito PA, Maron BJ. Influence of aging on Doppler echocardiographic indices of left ventricular diastolic function. Heart. 1988;59:672-9.
66. Ahmed SS, Jaferi GA, Narang RM, Regan TJ. Preclinical abnormality of left ventricular function in diabetes mellitus. American heart journal. 1975;89:153-8.
67. Vanninen E, Mustonen J, Vainio P, Länsimies E, Uusitupa M. Left ventricular function and dimensions in newly diagnosed non-insulin-dependent diabetes mellitus. The American journal of cardiology. 1992;70:371-8.
68. Takahashi N, Iwasaka T, Sugiura T, Hasegawa T, Tarumi N, Inada M. Diastolic time in diabetes: impairment of diastolic time during dynamic exercise in type 2 diabetes with retinopathy. Chest. 1991;100:748-53.
69. Uusitupa M, Mustonen J, Laakso M, Vainio P, Länsimies E, Talwar S, Pyörälä K. Impairment of diastolic function in middle-aged type 1 (insulin-dependent) and type 2 (non-insulin-dependent) diabetic patients free of cardiovascular disease. Diabetologia. 1988;31:783-91.
70. Zarich SW, Arbuckle BE, Cohen LR, Roberts M, Nesto RW. Diastolic abnormalities in young asymptomatic diabetic patients

assessed by pulsed Doppler echocardiography. Journal of the American College of Cardiology. 1988;12:114-20

71. Johnstone D, Limacher M, Rousseau M, Liang CS, Ekelund L, Herman M, et al. Clinical characteristics of patients in Studies of Left Ventricular Dysfunction (SOLVD). Am J Cardiol. 1992;70:894–900.
72. Vered ZV, Battler A, Segal P, Liberman D, Yerushalmi Y, Berezin M, Neufeld HN. Exercise-induced left ventricular dysfunction in young men with asymptomatic diabetes mellitus (diabetic cardiomyopathy). The American journal of cardiology. 1984;54:633-7.
73. Pérez JE, McGill JB, Santiago JV, Schechtman KB, Waggoner AD, Miller JG, Sobel BE. Abnormal myocardial acoustic properties in diabetic patients and their correlation with the severity of disease. Journal of the American College of Cardiology. 1992;19:1154-62.
74. Dash HA, Johnson RA, Dinsmore RE, Harthorne JW. Cardiomyopathic syndrome due to coronary artery disease. I: Relation to angiographic extent of coronary disease and to remote myocardial infarction. British heart journal. 1977;39:733.
75. Mildenberger RR, Bar-Shlomo B, Druck MN, Jablonsky G, Morch JE, Hilton JD, Kenshole AB, Forbath N, McLaughlin PR. Clinically unrecognized ventricular dysfunction in young diabetic patients. Journal of the American College of Cardiology. 1984;4:234-8.
76. Shapiro LM, Leatherdale BA, Coyne ME, Fletcher RF, Mackinnon J. Prospective study of heart disease in untreated maturity onset diabetics. British heart journal. 1980;44:342.
77. Rynkiewicz AN, Semetkowska-Jurkiewicz E, Wyrzykowski BO. Systolic and diastolic time intervals in young diabetics. Heart. 1980;44:280-3.
78. Airaksinen J, Ikäheimo M, Kaila J, Linnaluoto M, Takkunen J. Impaired Left Ventricular Filling in Young Female Diabetics: An Echocardiographic Study. Acta Med Scand. 1984;216:509–16.

79. Margonato A, Gerundini P, Vicedomini G, Gilardi MC, Pozza G, Fazio F. Abnormal cardiovascular response to exercise in young asymptomatic diabetic patients with retinopathy. American Heart Journal.1986;112:554-60.
80. Takenaka K, Sakamoto T, Amano K, Oku J, Fujinami K, Murakami T, Toda I, Kawakubo K, Sugimoto T. Left ventricular filling determined by Doppler echocardiography in diabetes mellitus. The American journal of cardiology. 1988;61:1140-3.
81. Mustonen JN, Uusitupa MI, Tahvanainen K, Talwar S, Laakso M, Länsimies E, Kuikka JT, Pyörälä K. Impaired left ventricular systolic function during exercise in middle-aged insulin-dependent and noninsulin-dependent diabetic subjects without clinically evident cardiovascular disease. The American journal of cardiology.1988;62:1273-9.
82. Mäntysaari M, Kuikka J, Mustonen J, Tahvanainen K, Vanninen E, Länsimies E, Uusitupa M. Impaired ventricular repolarization associated with disturbed left ventricular sympathetic function and diastolic filling in diabetes. American heart journal.1993;125:1458-60.
83. G tzsche O, Sihm I, Lund S, Schmitz O. Abnormal changes in transmitral flow after acute exposure to nitroglycerin and nifedipine in uncomplicated insulin-dependent diabetes mellitus: a Doppler echocardiographic study. American Heart Journal.1993;126:1417-26.
84. Jaffe AS, Spadaro JJ, Schechtman K, Roberts R, Geltman EM, Sobel BE. Increased congestive heart failure after myocardial infarction of modest extent in patients with diabetes mellitus. American heart journal.1984;108:31-7.
85. J Chlumský J. Vliv kompenzace diabetu na diastolické plnění levé komory srdecní [The effect of compensation in diabetes on left ventricular diastolic filling]. Vnitr Lek.1994; 40:93-5.
86. Tong NW, Yang TG, Liang JZ. [Ventricular late potentials in patients with diabetes mellitus]. Zhonghua Nei Ke Za Zhi. 1993; 32:464-6.

87. Grossman E, Shemesh J, Shamiss A, Thaler M, Carroll J, Rosenthal T. Left ventricular mass in diabetes-hypertension. Arch Intern Med. 1992;152:1001-4.
88. Mathew P, John L, Jose J, Krishnaswami S. Assessment of left ventricular diastolic function in young diabetics--a two dimensional echo Doppler study. Indian Heart J. 1992;44:29-32.
89. Hiramatsu K, Ohara N, Shigematsu S, Aizawa T, Ishihara F, Niwa A, et al. Left ventricular filling abnormalities in non-insulin-dependent diabetes mellitus and improvement by a short-term glycemic control. The American journal of cardiology. 1992;70:1185-9.
90. Ferraro S, Perrone-Filardi P, Maddalena G, Desiderio A, Gravina E, Turco S, et al. Comparison of left ventricular function in insulin- and non-insulin-dependent diabetes mellitus. The American journal of cardiology. 1993;71409-14.
91. Lababidi ZA, Goldstein DE. High prevalence of echocardiographic abnormalities in diabetic youths. Diabetes care.1983;6:18-22.
92. Rokey RO, Kuo LC, Zoghbi WA, Limacher MC, Quiñones MA. Determination of parameters of left ventricular diastolic filling with pulsed Doppler echocardiography: comparison with cineangiography. Circulation.1985;71:543-50.
93. Szlachcic J, Tubau JF, O'Kelly B, Massie BM. Correlates of diastolic filling abnormalities in hypertension: a Doppler echocardiographic study. American heart journal. 1990;120:386-91.
94. Nolan SP, Dixon SH, Fisher RD, Morrow AG. The influence of atrial contraction and mitral valve mechanics on ventricular filling. A study of instantaneous mitral valve flow in vivo. Am Heart J. 1969;77:784–91.
95. Hammermeister KE, Warbasse JR. The rate of change of left ventricular volume in man. II. Diastolic events in health and disease. Circulation. 1974;49:739–47.
96. Takenaka K, Dabestani A, Waffarn F, Gardin JM, Henry WL. Effect of left ventricular size on early diastolic left ventricular filling

in neonates and in adults. Am J Cardiol. 1987;59:138–41.

97. Poulsen MK, Henriksen JE, Dahl J, Johansen A, Gerke O, Vach W, Haghfelt T, H ilund-Carlsen PF, Beck-Nielsen H. Left ventricular diastolic function in type 2 diabetes mellitus: prevalence and association with myocardial and vascular disease. Circulation: Cardiovascular Imaging.2010;3:24-31.
98. Exiara T, Konstantis A, Papazoglou L, Kouroupi M, Kalpaka A, Mporgi L, et al. Left ventricular diastolic dysfunction in diabetes mellitus type 2: J Hypertens. 2010;28:e294.
99. Mishra TK, Rath PK, Mohanty NK, Mishra SK. Left ventricular systolic and diastolic dysfunction and their relationship with microvascular complications in normotensive, asymptomatic patients with type 2 diabetes mellitus. Indian Heart J. 2008;60:548-53.
100. Soldatos G, Jandeleit-Dahm K, Thomson H, Formosa M, D'orsa K, Calkin AC, Cooper ME, Ahimastos AA, Kingwell BA. Large artery biomechanics and diastolic dysfunctionin patients with Type 2 diabetes. Diabetic Medicine. 2011;28:54-60.
101. Sacre JW, Franjic B, Jellis CL, Jenkins C, Coombes JS, Marwick TH. Association of cardiac autonomic neuropathy with subclinical myocardial dysfunction in type 2 diabetes. JACC: Cardiovascular Imaging. 2010;3:1207-15.
102. Masugata H, Senda S, Goda F, Yoshihara Y, Yoshikawa K, Fujita N, et al. Left ventricular diastolic dysfunction in normotensive diabetic patients in various age strata. Diabetes research and clinical practice. 2008;79:91-6.
103. Annonu AKMH, Fattah AA, Mokhtar MS, Ghareeb S, Elhendy A. Left ventricular systolic and diastolic functional abnormalities in asymptomatic patients with non-insulin-dependent diabetes mellitus. J Am Soc Echocardiogr. 2001;14:885–91.
104. Ashraf SMS, Basir F. Association of hypertension and diastolic dysfunction with type-2 diabetes mellitus [Internet]. [Cited 2020 Dec 3]. Available from: https://www.researchgate.net/publication/281892234_Association

_of_hypertension_and_diastolic_dysfunction_with_type-2_diabetes_mellitus

105. Diamant M, Lamb HJ, Groeneveld Y, Endert EL, Smit JW, Bax JJ, et al. Diastolic dysfunction is associatedwith altered myocardial metabolism inasymptomatic normotensive patientswith well-controlled type 2 diabetes mellitus. Journal of the American College of Cardiology. 2003;42:328-35.
106. Bonito PD, Cuomo S, Moio N, Sibilio G, Sabatini D, Quattrin S, Capaldo B. Diastolic dysfunction in patients with non-insulin-dependent diabetes mellitus of short duration. Diabetic medicine. 1996;13:321-4.
107. From AM, Scott CG, Chen HH. The Development of Heart Failure in Patients with Diabetes Mellitus and Pre-Clinical Diastolic Dysfunction. A Population-Based Study. J Am Coll Cardiol. 2010;55:300–5.
108. Boyer JK, Thanigaraj S, Schechtman KB, Pérez JE. Prevalence of ventricular diastolic dysfunction in asymptomatic, normotensive patients with diabetes mellitus. Am J Cardiol. 2004;93:870–5.
109. Takeda Y, Sakata Y, Mano T, Ohtani T, Kamimura D, Tamaki S, et al. Competing risks of heart failure with preserved ejection fraction in diabetic patients. European journal of heart failure. 2011;13:664-9.
110. Poantă L, Fodor D, Albu A. Left ventricular function in patients with uncomplicated well-controlled diabetes mellitus. Med Ultrason. 2010;12:184-7.
111. Poirier P, Bogaty P, Philippon F, Garneau C, Fortin C, Dumesnil JG. Preclinical diabetic cardiomyopathy: relation of left ventricular diastolic dysfunction to cardiac autonomic neuropathy in men with uncomplicated well-controlled type 2 diabetes. Metabolism. 2003;52:1056-61.
112. Hameedullah FM, Bahadar S, Hafizullah M, Najeeb S. Effect of glycaemic status on left ventricular diastolic function in normotensive type 2 diabetic patients. J Ayub Med Coll Abbottabad. 2009;21:139-44.

113. Schannwell CM, Schneppenheim M, Perings S, Plehn G, Strauer BE. Left ventricular diastolic dysfunction as an early manifestation of diabetic cardiomyopathy. Cardiology. 2002;98:33-9.
114. Fontes-Carvalho R, Ladeiras-Lopes R, Bettencourt P, Leite-Moreira A, Azevedo A. Diastolic dysfunction in the diabetic continuum: association with insulin resistance, metabolic syndrome and type 2 diabetes. Cardiovascular diabetology. 2015;14:4.
115. Goldweit RS, Borer JS, Jovanovic LG, Drexler AJ, Hochreiter CA, Devereux RB, Peterson CM. Relation of hemoglobin A1 and blood glucose to cardiac function in diabetes mellitus. The American journal of cardiology. 1985;56:642-6.
116. Schmidt A, Grosmann G, Hauner H, Koenig W, Jansen T, Stauch M, et al. Left ventricular function and wall thickness in long-term insulin-dependent diabetes mellitus: an echocardiographic study. Journal of internal medicine. 1991;229:527-31.
117. Celentano A, Vaccaro O, Tammaro P, Galderisi M, Crivaro M, Oliviero M, et al. Early abnormalities of cardiac function in non-insulin-dependent diabetes mellitus and impaired glucose tolerance. Am J Cardiol. 1995;76:1173–6.
118. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. European heart journal. 2016;37:2129-200.
119. Piccini JP, Klein L, Gheorghiade M, Bonow RO. New insights into diastolic heart failure: role of diabetes mellitus. The American journal of medicine. 2004;116:64-75.
120. Iribarren C, Karter AJ, Go AS, Ferrara A, Liu JY, Sidney S, et al. Glycemic control and heart failure among adult patients with diabetes. Circulation. 2001;103:2668–73.
121. Sánchez-Barriga JJ, Rangel A, Castañeda R, Flores D, Frati AC,

Ramos MA, et al. Left ventricular diastolic dysfunction secondary to hyperglycemia in patients with type II diabetes. Archives of medical research. 2001;32:44-7.

122. Cosson S, Kevorkian JP. Left ventricular diastolic dysfunction: An early sign of diabetic cardiomyopathy? Vol. 29, Diabetes and Metabolism. Elsevier Masson SAS; 2003. p. 455–66.
123. Freire CM, Nunes MD, Barbosa MM, de Oliveira Longo JR, Nogueira AI, Diniz SS, et al. Gestational diabetes: a condition of early diastolic abnormalities in young women. Journal of the American Society of Echocardiography. 2006;19:1251-6.
124. Patil VC, Shah KB, Vasani JD, Shetty P, Patil HV. Diastolic dysfunction in asymptomatic type 2 diabetes mellitus with normal systolic function. Journal of cardiovascular disease research.2011;2:213-22.
125. van Heerebeek L, Hamdani N, Handoko ML, Falcao-Pires I, Musters RJ, Kupreishvili K, et al. Diastolic stiffness of the failing diabetic heart: importance of fibrosis, advanced glycation end products, and myocyte resting tension. Circulation. 2008;117:43-51.
126. Nagueh SF, Appleton CP, Gillebert TC, Marino PN, Oh JK, Smiseth OA, et al. Recommendations for the evaluation of left ventricular diastolic function by echocardiography. European Journal of Echocardiography. 2009;10:165-93.
127. Ommen SR, Nishimura RA, Appleton CP, Miller FA, Oh JK, Redfield MM, et al. Clinical utility of Doppler echocardiography and tissue Doppler imaging in the estimation of left ventricular filling pressures: a comparative simultaneous Doppler-catheterization study. Circulation. 2000;102:1788-94.
128. Drazner MH, Rame JE, Marino EK, Gottdiener JS, Kitzman DW, Gardin JM, et al. Increased left ventricular mass is a risk factor for the development of a depressed left ventricular ejection fraction within five years: the Cardiovascular Health Study. Journal of the American College of Cardiology. 2004;43:2207-15.
129. Hamby RI, Zoneraich S, Sherman L. Diabetic cardiomyopathy.

JAMA. 1974;229:1749-54.

130. Levy D, Garrison RJ, Savage DD, Kannel WB, Castelli WP. Left ventricular mass and incidence of coronary heart disease in an elderly cohort: the Framingham Heart Study. Annals of internal medicine. 1989;110:101-7.
131. Levy D, Garrison RJ, Savage DD, Kannel WB, Castelli WP. Prognostic implications of echocardiographically determined left ventricular mass in the Framingham Heart Study. New England Journal of Medicine. 1990;322:1561-6.
132. Kuperstein R, Hanly P, Niroumand M, Sasson Z. The importance of age and obesity on the relation between diabetes and left ventricular mass. Journal of the American College of Cardiology. 2001;37:1957-62.
133. Benjamin EJ, D'Agostino RB, Belanger AJ, Wolf PA, Levy D. Left atrial size and the risk of stroke and death: the Framingham Heart Study. Circulation. 1995;92:835-41.
134. Møller JE, Hillis GS, Oh JK, Seward JB, Reeder GS, Wright RS, Park SW, Bailey KR, Pellikka PA. Left atrial volume: a powerful predictor of survival after acute myocardial infarction. Circulation. 2003;107:2207-12.
135. Sabharwal N, Cemin R, Rajan K, Hickman M, Lahiri A, Senior R. Usefulness of left atrial volume as a predictor of mortality in patients with ischemic cardiomyopathy. The American journal of cardiology. 2004;94:760-3.
136. Poulsen MK, Dahl JS, Henriksen JE, Hey TM, Høilund-Carlsen PF, Beck-Nielsen H, et al. Left atrial volume index: relation to long-term clinical outcome in type 2 diabetes. Journal of the American College of Cardiology. 2013;62:2416-21.

SR NO	NAME	MRD. NO	AGE	AGE GROUP	SEX
1	PR	597819	58	2	M
2	MS	633942	63	3	M
3	AS	230119	43	1	M
4	GK	633291	48	1	M
5	GS	634054	59	2	M
6	MS	633988	65	3	M
7	BS	212239	57	2	M
8	SK	614903	55	2	M
9	NS	629643	36	1	M
10	DK	633984	58	2	M
11	PS	609172	58	2	M
12	RK	638143	67	3	M
13	GS	375377	76	3	M
14	FC	638444	63	3	M
15	SG	638454	51	2	M
16	HS	266622	61	3	M
17	HS	51792	62	3	M
18	AK	382604	47	1	M
19	SK	641563	65	3	M
20	RP	634656	46	1	M
21	VKS	409542	56	2	M
22	RS	624768	45	1	M
23	SS	389826	63	3	M
24	AM	118058	43	1	M
25	KS	642222	48	1	M
26	GS	408041	51	2	M
27	RL	162561	57	2	M
28	AM	351095	66	3	M
29	RS	456708	45	1	M
30	GS	433034	62	3	M
31	SS	645760	65	3	M
32	RPS	610364	45	1	M
33	AC	38918	60	2	M
34	VB	579716	50	2	M
35	HS	647600	63	3	M
36	RB	647895	66	3	M
37	HS	77900	54	2	M
38	JS	725511	64	3	M
39	VKS	729480	64	3	M
40	TS	725189	60	2	M
41	PK	739936	59	2	M
42	GS	508374	53	2	M
43	NS	160975	49	1	M
44	MY	735573	44	1	M
45	KS	729630	42	1	M
46	GL	705948	50	2	M
47	JK	148761	35	1	M
48	DS	741381	56	2	M
49	JS	312920	50	2	M

50	KKJ	252524	68	3	M
51	RKD	406460	57	2	M
52	JS	318678	51	2	M
53	BD	732595	57	2	M
54	GS	50837	52	2	M
55	BS	732579	65	3	M
56	GG	730892	48	1	M
57	KS	727162	46	1	M
58	DC	658637	67	3	M
59	RK	757462	45	1	M
60	JS	662643	62	3	M
61	RD	659442	65	3	M
62	JS	657040	51	2	M
63	VKS	675902	60	2	M
64	SS	675927	62	3	M
65	MK	672995	59	2	M
66	JN	656098	59	2	M
67	RS	694177	53	2	M
68	KS	569426	60	2	M
69	PS	755876	72	3	M
70	MS	752798	57	2	M
71	TR	771903	69	3	M
72	HS	774937	53	2	M
73	BS	196641	37	1	M
74	GS	786315	57	2	M
75	PK	250390	50	2	M
76	RJ	204998	60	2	M
77	BK	799543	50	2	M
78	NS	761187	55	2	M
79	RK	757462	45	1	M
80	RKK	438444	56	2	M
81	JS	728869	65	3	M
82	NK	657701	55	2	M
83	GK	725304	50	2	M
84	BJG	719355	60	2	M
85	LRB	730161	61	3	M
86	GS	295668	82	3	M
87	JB	800474	45	1	M
88	PK	660262	44	1	M
89	HB	482026	66	3	M
90	RS	662346	65	3	M
91	MW	625825	60	2	M
92	SKS	650496	66	3	M
93	SS	410689	67	3	M
94	JS	289261	42	1	M
95	SG	653395	57	2	M
96	A	488433	66	3	M
97	SG	408665	70	3	M
98	DS	167257	68	3	M
99	RJ	390256	48	1	M

100	KC	281129	69	3	M
101	SS	660481	65	3	M
102	JS	660369	61	3	M
103	MS	67531	55	2	M
104	JS	658782	64	3	M
105	ASS	659429	52	2	M
106	HS	659430	47	1	M
107	BK	659416	52	2	M
108	PK	657686	70	3	M
109	RK	310522	56	2	M
110	MP	656728	65	3	M
111	VVS	63064	63	3	M
112	SK	658174	54	2	M
113	JSS	655552	69	3	M
114	JS	657623	60	2	M
115	DK	630296	57	2	M
116	SS	590811	54	2	M
117	BB	656550	46	1	M
118	RC	656131	55	2	M
119	SL	662472	59	2	M
120	RS	662346	65	3	M
121	MW	625825	60	2	M
122	SKS	650496	66	3	M
123	SS	410689	67	3	M
124	JS	289261	41	1	M
125	SG	653395	57	2	M
126	A	488433	65	3	M
127	SG	408665	70	3	M
128	DSB	16725	69	3	M
129	RJ	390256	47	1	M
130	RPS	610364	46	1	M
131	GS	650101	60	2	M
132	HC	649930	58	2	M
133	PJ	651091	65	3	M
134	KS	650705	42	1	M
135	HS	354821	72	3	M
136	GL	144379	57	2	M
137	DS	650256	65	3	M
138	BS	240369	68	3	M
139	SG	648508	54	2	M
140	DS	649758	52	2	M
141	MS	649708	46	1	M
142	BS	179481	54	2	M
143	DG	649488	62	3	M
144	PK	65330	55	2	M
145	AB	394301	58	2	M
146	PK	443290	55	2	M
147	JS	624283	66	3	M
148	RS	917519	46	1	M
149	MSB	796209	58	2	M

150	JS	312920	48	1	M
151	LS	377037	70	3	M
152	BS	748597	57	2	M
153	RS	120077	60	2	M
154	IS	739950	54	2	M
155	JS	438489	65	3	M
156	HS	300080	40	1	M
157	DC	709614	72	3	M
158	PK	705266	46	1	M
159	AS	685217	60	2	M
160	PKJ	681732	51	2	M
161	JS	681810	63	3	M
162	PS	680940	47	1	M
163	RS	678216	61	3	M
164	HK	673001	63	3	M
165	NK	666969	63	3	M
166	SM	666248	62	3	M
167	MS	151405	73	3	M
168	GT	648976	68	3	M
169	VKS	674380	67	3	M
170	RSB	663277	62	3	M
171	RK	718647	54	2	M
172	JS	709886	66	3	M
173	SP	207710	69	3	M
174	GS	277217	74	3	M
175	RD	176524	66	3	M
176	BK	342092	54	2	M
177	JS	63559	65	3	M
178	RB	798544	58	2	M
179	JP	833383	66	3	M
180	PK	730032	55	2	M
181	SS	734345	64	3	M
182	GS	481720	48	1	M
183	GS	508374	52	2	M
184	GMM	685416	79	3	M
185	GS	507554	36	1	M
186	DS	313067	60	2	M
187	KKG	475945	60	2	M
188	SS	916216	65	3	M
189	SR	644160	36	1	M
190	VKS	641685	66	3	M
191	AK	339621	37	1	M
192	JRK	638627	64	3	M
193	SPS	123069	46	1	M
194	GKK	45151	66	3	M
195	RKJ	898019	54	2	M
196	SS	895225	57	2	M
197	MSK	892131	53	2	M
198	JS	635343	54	2	M
199	RG	881186	64	3	M

200	SL	119067	65	3	M
201	DK	876799	63	3	M
202	JC	256768	67	3	M
203	DS	219380	50	2	M
204	KD	631978	74	3	F
205	AJ	6238	49	1	F
206	SK	644622	60	2	F
207	VK	585855	64	3	F
208	SK	644622	60	2	F
209	JK	650849	72	3	F
210	RS	610364	45	1	F
211	KD	647640	62	3	F
212	UR	648244	65	3	F
213	MK	736968	38	1	F
214	SB	722125	48	1	F
215	ND	705201	57	2	F
216	GR	733233	66	3	F
217	NK	730918	63	3	F
218	LD	722424	47	1	F
219	RC	201154	56	2	F
220	KR	677468	44	1	F
221	AR	757461	58	2	F
222	RK	666457	50	2	F
223	HB	664723	53	2	F
224	CG	782906	60	2	F
225	MK	242616	60	2	F
226	R	758005	50	2	F
227	HB	787040	69	3	F
228	S	786458	40	1	F
229	MK	787109	46	1	F
230	MK	242616	60	2	F
231	SD	778364	52	2	F
232	PM	626343	54	2	F
233	SD	781487	45	1	F
234	PK	603273	70	3	F
235	KD	658730	56	2	F
236	SK	725976	65	3	F
237	AG	728869	66	3	F
238	PK	75941	52	2	F
239	BK	661761	63	3	F
240	DR	660929	60	2	F
241	PR	661311	40	1	F
242	SN	661172	51	2	F
243	RK	656773	48	1	F
244	AA	653036	55	2	F
245	DK	650339	64	3	F
246	AS	36855	53	2	F
247	KD	6077254	59	2	F
248	RPS	610364	46	1	F
249	VP	660399	54	2	F

250	SD	659492	64	3	F
251	BK	659416	52	2	F
252	RPS	657599	65	3	F
253	AK	153605	62	3	F
254	RR	656868	56	2	F
255	BK	494630	42	1	F
256	AK	615024	68	3	F
257	DR	660929	60	2	F
258	VA	651673	66	3	F
259	SN	661172	51	2	F
260	RK	656773	49	1	F
261	AA	653036	55	2	F
262	KK	655530	85	3	F
263	DK	650339	62	3	F
264	AS	36855	52	2	F
265	KD	607254	58	2	F
266	JK	436598	61	3	F
267	JK	651391	58	2	F
268	PV	650679	52	2	F
269	AJ	803893	63	3	F
270	SB	777723	46	1	F
271	N	756786	60	2	F
272	AN	749769	49	1	F
273	SKC	98054	61	3	F
274	HK	734280	50	2	F
275	PK	70644	52	2	F
276	KR	706110	59	2	F
277	LD	722424	47	1	F
278	SK	45812	51	2	F
279	NR	673091	56	2	F
280	KK	651288	47	1	F
281	K	651681	69	3	F
282	SS	669456	60	2	F
283	UB	60554	64	3	F
284	SK	716241	47	1	F
285	HK	752143	55	2	F
286	SD	147985	81	3	F
287	MK	638603	58	2	F
288	BK	77049	55	2	F
289	KK	903247	71	3	F
290	JK	898579	66	3	F
291	AR	150046	57	2	F
292	PR	447930	53	2	F
293	KM	679699	50	2	F
294	RK	485521	70	3	F
295	KK	894185	60	2	F
296	DB	874614	70	3	M
297	KK	643615	81	3	F
298	VJ	164770	55	2	M
299	DR	233528	63	3	F

300	SM	238356	63	3	M

PRESENTING COMPLAINTS _DYSPNOEA	CHEST PAIN	FATIGUE
NO	NO	NO
Y	NO	NO
NO	Y	NO
Y	NO	NO
Y	NO	Y
NO	NO	Y
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
Y	NO	NO
NO	NO	NO
Y	NO	Y
NO	NO	Y
NO	NO	NO
NO	NO	Y
Y	NO	Y
NO	NO	Y
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	Y
NO	NO	Y
NO	NO	NO
NO	NO	Y
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
Y	NO	NO
NO	Y	NO
NO	NO	NO
Y	NO	NO
NO	Y	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
Y	NO	NO
NO	NO	Y
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	Y
NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
Y	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
Y	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
Y	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
Y	Y	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
NO	NO	NO
Y	Y	NO
Y	NO	NO
Y	NO	NO
Y	NO	NO
Y	NO	NO

NO	NO	NO

EXERCISE AND PHYSICAL ACTIVITY	PALPITATIONO	SYNCOPE
NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO
NO	NO	NO
NO	NO	NO

NO	NO	NO

WEIGHT LOSS	SWELLING LEGS
NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO

NO	NO

DISORDERED BREATHING AT NIGHT OBSTRUCTIVE SLEEP APNOEA
NO
NO
NO

NO
NO
NO

NO
NO
NO

NO
NO
NO

NO
NO
NO

NO
NO
NO

NO

RECENT OR FREQUENT PRIOR HOSPITALISATION
NO
NO
NO

NO
NO
NO
NO
NO
NO
NO
GHABRAHAT
NO
NO
NO
NO
NO
NO

NO
NO
NO

NO
NO
NO

NO
NO
NO

NO
NO
NO

NO

PAST HISTORY_HYPERTENSION	DURATION	RENAL FAILURE	DURATION
NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
Y	5	NO	
NO		NO	
Y	5	NO	
NO		NO	
NO		NO	
Y	15	NO	
NO		NO	
NO		NO	
NO		NO	
Y	27	NO	
Y	4	NO	
Y	7	NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
Y	30	NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
Y	2	NO	
Y	2	NO	
NO		NO	
Y	10	NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO

NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
Y	5	NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
Y	20	NO	
NO		NO	
NO		NO	
Y	30	NO	
NO		NO	
Y	8	NO	
Y	12	NO	
NO		NO	
NO		NO	
NO		NO	
Y	10	NO	
Y	1	NO	
NO		NO	
Y	21	NO	
NO		NO	
Y	15	NO	
Y	1	NO	
NO		NO	
NO	6	NO	
Y	4	NO	
NO		NO	
NO		NO	
Y	5	NO	
Y	4	NO	
Y	6	NO	
Y	7	NO	
y	2	NO	

NO		NO	

CARDIAC DISEASE	DURATION	PULMONARY DISEASE	DURATION
NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	

THYROID DISORDER	DURATION	TUBERCULOSIS	DURATION
NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	

NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
Y	6	NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO

NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
Y	6	NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
Y	6	NO	
NO		Y	13
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
Y	5	NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	
NO		NO	

NO		NO	

BRONCHIAL ASTHMA	DURATION	DIABETES MELLITUS
NO		Y
NO		Y
NO		Y

NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
N0		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y

NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
N0		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
NO		Y
N		Y
N		Y
N		Y
N		Y
N		Y

NO		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
NO		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y
N		Y

N		Y
Y	35	Y
N		Y
N		Y
N

N		Y
N		Y
N		Y

N		Y

DURATION(years)	DM DURATION
8	1
10	1
9	1
7	1
8	1
10	1
12	2
12	2
7	1
8	1
8	1
10	1
10	1
10	1
12	2
10	1
10	1
10	1
18	2
7	1
12	2
10	1
10	1
10	1
10	1
16	2
8	1
8	1
10	1
15	2
10	1
7	1
10	1
8	1
12	2
12	2
10	1
13	2
13	2
20	2
18	2
13	2
13	2
12	2
10	1
10	1
9	1
10	1
10	1

10	1
10	1
8	1
36	2
14	2
18	2
14	2
12	2
15	2
12	2
10	1
10	1
15	2
27	2
15	2
29	2
7	1
7	1
12	2
20	2
17	2
12	2
13	2
10	1
10	1
12	2
7	1
7	1
10	1
10	1
10	1
10	1
12	2
12	2
9	1
10	1
10	1
10	1
15	2
10	1
10	1
10	1
14	2
12	2
12	2
8	1
10	1
10	1
12	2
10	1

10	1
12	2
10	1
8	1
12	2
10	1
12	2
10	1
12	2
11	2
10	1
12	2
10	1
10	1
10	1
10	1
16	2
10	1
14	2
10	1
10	1
12	2
15	2
10	1
10	1
12	2
10	1
12	2
12	2
10	1
10	1
10	1
15	2
10	1
10	1
10	1
10	1
8	1
10	1
10	1
10	1
10	1
10	1
17	2
10	1
12	2
8	1
21	2
8	1
10	1

10	1
7	1
17	2
10	1
9	1
30	2
10	1
15	2
10	1
10	1
20	2
10	1
8	1
11	2
10	1
9	1
10	1
10	1
18	2
10	1
10	1
10	1
8	1
25	2
10	1
8	1
12	2
8	1
12	2
32	2
8	1
8	1
7	1
18	2
10	1
7	1
10	1
18	2
10	1
9	1
8	1
10	1
12	2
14	2
12	2
15	2
7	1
12	2
15	2
8	1

8	1
10	1
8	1
18	2
10	1
10	1
10	1
10	1
8	1
10	1
7	1
8	1
10	1
10	1
10	1
10	1
12	2
7	1
8	1
10	1
18	2
15	2
13	2
10	1
10	1
15	2
10	1
19	2
10	1
10	1
10	1
8	1
10	1
12	2
10	1
10	1
8	1
10	1
10	1
12	2
11	2
10	1
10	1
12	2
14	2
10	1
10	1
10	1
10	1
12	2

10	1
10	1
10	1
10	1
10	1
12	2
10	1
10	1
12	2
10	1
8	1
10	1
25	2
10	1
10	1
10	1
10	1
9	1
10	1
12	2
21	2
15	2
8	1
13	2
15	2
7	1
10	1
11	2
8	1
12	2
10	1
10	1
7	1
10	1
10	1
7	1
10	1
10	1
15	2
8	1
13	2
7	1
8	1
13	2
20	2
7	1
10	1
10	1
12	2
10	1

12	2

PERSONAL HISTORY_ALCOHOL CONSUMPTION	SMOKING
NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO
NO	NO
NO	NO
NO	NO
Y	NO
Y	NO
NO	NO
NO	NO
Y	NO
NO	NO
NO	NO
Y	NO
NO	NO
NO	Y
Y	NO
Y	NO
NO	NO
NO	NO
NO	NO
NO	NO
NO

NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO

NO	NO
NO	NO
NO	NO

NO	NO

ANY OTHER ADDICTION OR ILLICIT DRUG ABUSE (IF ANY)
NO
NO
NO

NO
NO
NO

NO
NO
NO

NO
NO
NO

NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
SN
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO
NO

NO
NO
NO

NO

LIFE STYLE (SEDENTARY/ MODERATE ACTIVITY/ HEAVY PHYSICAL ACTIVITY)
S
S
S
S
S
MA
MA
S
MA
S
MA
S
MA
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
MA
S
MA
S
S
S
S
S
S
S

S
S
S
S
MA
S
S
S
S
S
S
MA
S
S
S
S
MA
MA
S
S
S
S
S
S

S
S
S

S
S
S
S
S
MA
MA
S
MA
S
MA
S
S
S
S

MA
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
MA
S
MA
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S

S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
MA
MA
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
S
MA
S
MA
S
S
S
S
S
S

S

SBP	DBP	SBP1	DBP1	SBP2	DBP2	SBP3	DBP3	PULSE
120	73	120	70	120	80	120	70	80
130	80	130	80	130	80	130	80	102
137	80	140	80	140	80	130	80	80
137	70	140	70	130	70	140	70	88
133	80	140	80	130	80	130	80	78
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	90
130	77	130	70	130	80	130	80	80
130	73	130	80	130	70	130	70	88
130	73	130	80	130	70	130	70	80
137	80	140	80	140	80	130	80	80
120	80	120	80	120	80	120	80	88
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	80
127	60	130	80	130	80	120	20	80
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	78
120	80	120	80	120	80	120	80	90
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
133	80	140	80	130	80	130	80	80
130	80	130	80	130	80	130	80	80
130	80	130	80	130	80	130	80	90
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
140	80	140	80	140	80	140	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
140	80	140	80	140	80	140	80	90
140	80	140	80	140	80	140	80	90
120	70	120	70	120	70	120	70	70
130	73	130	80	130	70	130	70	74
130	70	130	70	130	70	130	70	112
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
123	80	130	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80

120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	70	120	70	120	70	120	70	76
130	70	130	70	130	70	130	70	112
130	70	130	70	130	70	130	70	76
100	77	100	70	100	80	100	80	80
130	80	130	80	130	80	130	80	80
130	70	130	70	130	70	130	70	80
106	63	100	60	110	70	108	60	88
110	70	110	70	110	70	110	70	102
110	70	110	70	110	70	110	70	72
140	90	140	90	140	90	140	90	70
140	90	140	90	140	90	140	90	80
130	80	130	80	130	80	130	80	80
153	80	150	80	150	80	160	80	80
115	73	114	70	120	80	110	70	110
140	80	140	80	140	80	140	80	94
153	80	160	80	150	80	150	80	92
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
123	80	130	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
133	83	140	90	130	80	130	80	76
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
127	80	130	80	130	80	120	80	80
120	80	120	80	120	80	120	80	80
130	83	130	90	130	80	130	80	80
120	80	120	80	120	80	120	80	80
123	80	120	80	120	80	130	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	90
130	80	130	80	130	80	130	80	80
130	80	130	80	130	80	130	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80

130	80	130	80	130	80	130	80	80
123	80	130	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	70	120	70	120	70	120	70	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
127	80	130	80	120	80	130	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
127	80	130	80	130	80	120	80	80
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	90
120	80	120	80	120	80	120	80	90
120	80	120	80	120	80	120	80	92
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	90
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
120	70	120	70	120	70	120	70	80
127	77	120	70	130	80	130	80	80
127	77	130	80	120	70	130	80	92
120	80	120	80	120	80	120	80	80
110	70	110	70	110	70	110	70	80

130	70	130	70	130	70	130	70	80
110	67	110	60	110	70	110	70	80
123	77	130	70	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	74
130	80	130	80	130	80	130	80	65
120	70	120	70	120	70	120	70	80
140	90	140	90	140	90	140	90	80
120	70	120	70	120	70	120	70	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	74
120	80	120	80	120	80	120	80	80
137	87	140	90	140	90	130	80	88
140	80	140	80	140	80	140	80	80
130	80	130	80	130	80	130	80	74
127	80	120	80	130	80	130	80	97
110	70	110	70	110	70	110	70	80
110	70	110	70	110	70	Apr-00	Mar-00	80
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	90
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
127	80	130	80	130	80	120	80	80
120	80	120	80	120	80	120	80	80
120	70	120	70	120	70	120	70	80
120	70	120	70	120	70	120	70	80
130	80	130	80	130	80	130	80	80
140	80	140	80	140	80	140	80	80
127	80	130	80	130	80	120	80	80
130	80	130	80	130	80	130	80	80
130	80	130	80	130	80	130	80	104
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
110	80	110	80	110	80	110	80	80
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
147	97	140	90	150	100	150	100	80
157	90	160	90	150	90	160	90	80
117	73	130	80	110	70	110	70	80
137	77	140	80	140	80	130	70	80
143	90	150	100	140	80	140	90	80
120	70	120	70	120	70	120	70	80

110	70	110	70	110	70	110	70	80
120	80	120	80	120	80	120	80	80
140	90	140	90	140	90	140	90	80
110	70	110	70	110	70	110	70	80
133	77	140	70	130	80	130	80	108
133	80	140	80	130	80	130	80	80
130	80	130	80	130	80	130	80	80
120	77	120	80	120	70	120	80	80
140	80	140	80	140	80	140	80	80
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	80
140	83	150	90	140	80	130	80	100
140	80	140	80	140	80	140	80	90
103	73	100	70	110	70	100	80	78
130	80	130	80	130	80	130	80	84
137	77	140	80	140	80	130	70	80
120	70	120	70	120	70	120	70	87
130	90	130	90	130	90	130	90	73
150	80	150	80	150	80	150	80	64
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	90
120	80	120	80	120	80	120	80	80
123	80	130	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	108
133	80	140	80	130	80	130	80	84
120	80	120	80	120	80	120	80	90
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
130	80	130	80	130	80	130	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
123	83	120	80	130	90	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80

123	80	120	80	120	80	130	80	90
120	80	120	80	120	80	120	80	80
123	80	130	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
123	80	130	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	88
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	77	120	70	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	90
140	90	140	90	140	90	140	90	80
127	80	120	80	130	80	130	80	88
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	100
120	80	120	80	120	80	120	80	74
123	80	130	80	120	80	120	80	100
203	100	210	100	200	100	200	100	102
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	64
107	70	100	70	110	70	110	70	78
133	80	140	80	130	80	130	80	80
110	73	110	80	110	70	110	70	80
130	80	130	80	130	80	130	80	80
127	77	130	80	130	80	120	70	80
120	80	120	80	120	80	120	80	80
143	80	150	80	140	80	140	80	80
193	80	200	80	190	80	190	80	80
123	80	130	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
120	80	120	80	120	80	120	80	80
123	80	120	80	120	80	130	80	80
140	70	140	70	140	70	140	70	80
133	80	140	80	130	80	130	80	80
133	73	140	80	130	70	130	70	80
133	67	140	60	130	70	130	70	80
120	70	120	70	120	70	120	70	80
120	80	120	80	120	80	120	80	80
113	70	110	70	120	70	110	70	88
147	97	150	100	140	90	150	100	86
93	60	90	60	100	60	90	60	80
120	70	120	70	120	70	120	70	80

127	80	120	80	140	80	120	80	80

RESP. RATE	TEMPERATURE	HEIGHT	WEIGHT
16	AFEBRILE	168	90
18	AFEBRILE	168	88
16	AFEBRILE	168	88
16	AFEBRILE	158	90
16	AFEBRILE	158	92
16	AFEBRILE	160	94
18	AFEBRILE	156	65
16	AFEBRILE	156	66
16	AFEBRILE	164	68
16	AFEBRILE	160	67
16	AFEBRILE	158	68
16	AFEBRILE	158	90
16	AFEBRILE	160	90
16	AFEBRILE	168	90
16	AFEBRILE	164	96
16	AFEBRILE	170	88
16	AFEBRILE	170	70
16	AFEBRILE	168	70
16	AFEBRILE	170	90
16	AFEBRILE	168	62
16	AFEBRILE	170	90
16	AFEBRILE	168	90
16	AFEBRILE	170	65
16	AFEBRILE	170	90
16	AFEBRILE	170	88
16	AFEBRILE	170	98
16	AFEBRILE	170	66
16	AFEBRILE	168	64
16	AFEBRILE	168	64
16	AFEBRILE	164	78
16	AFEBRILE	170	90
16	AFEBRILE	168	68
16	AFEBRILE	168	90
16	AFEBRILE	164	66
16	AFEBRILE	168	90
16	AFEBRILE	168	66
16	AFEBRILE	168	92
16	AFEBRILE	168	79
16	AFEBRILE	168	80
18	AFEBRILE	168	68
16	AFEBRILE	171	64
16	AFEBRILE	172	68
16	AFEBRILE	168	78
16	AFEBRILE	168	66
16	AFEBRILE	168	68
16	AFEBRILE	168	66
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	88

16	AFEBRILE	170	84
16	AFEBRILE	168	90
16	AFEBRILE	168	86
16	AFEBRILE	166	90
16	AFEBRILE	172	71
16	AFEBRILE	178	72
16	AFEBRILE	170	80
16	AFEBRILE	180	85
16	AFEBRILE	162	80
16	AFEBRILE	172	68
16	AFEBRILE	163	74
16	AFEBRILE	173	76
16	AFEBRILE	178	91
16	AFEBRILE	166	72
16	AFEBRILE	180	90
16	AFEBRILE	169	74
16	AFEBRILE	172	70
16	AFEBRILE	165	76
16	AFEBRILE	182	78
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	170	90
18	AFEBRILE	168	90
16	AFEBRILE	168	88
16	AFEBRILE	170	90
16	AFEBRILE	172	123
16	AFEBRILE	172	72
16	AFEBRILE	170	90
16	AFEBRILE	170	68
16	AFEBRILE	170	66
16	AFEBRILE	170	90
16	AFEBRILE	170	90
16	AFEBRILE	170	90
16	AFEBRILE	170	90
16	AFEBRILE	170	68
16	AFEBRILE	170	70
16	AFEBRILE	172	92
16	AFEBRILE	170	90
16	AFEBRILE	170	69
16	AFEBRILE	170	71
16	AFEBRILE	170	72
16	AFEBRILE	168	70
16	AFEBRILE	168	68
16	AFEBRILE	172	80
16	AFEBRILE	172	82
16	AFEBRILE	170	80
16	AFEBRILE	174	78
16	AFEBRILE	174	80
16	AFEBRILE	174	88
16	AFEBRILE	172	90

16	AFEBRILE	170	68
16	AFEBRILE	170	92
16	AFEBRILE	170	66
16	AFEBRILE	180	68
16	AFEBRILE	170	70
16	AFEBRILE	170	70
16	AFEBRILE	172	72
16	AFEBRILE	170	68
16	AFEBRILE	170	90
16	AFEBRILE	178	92
16	AFEBRILE	170	80
16	AFEBRILE	170	72
16	AFEBRILE	176	70
16	AFEBRILE	170	68
16	AFEBRILE	170	90
16	AFEBRILE	188	68
16	AFEBRILE	170	70
16	AFEBRILE	170	68
16	AFEBRILE	170	90
16	AFEBRILE	172	68
16	AFEBRILE	170	70
16	AFEBRILE	170	72
16	AFEBRILE	168	72
16	AFEBRILE	170	70
16	AFEBRILE	158	66
16	AFEBRILE	168	68
16	AFEBRILE	170	90
16	AFEBRILE	172	72
16	AFEBRILE	170	90
16	AFEBRILE	158	78
16	AFEBRILE	170	90
86	AFEBRILE	190	72
16	AFEBRILE	170	90
16	AFEBRILE	178	70
16	AFEBRILE	178	90
16	AFEBRILE	176	92
16	AFEBRILE	176	78
16	AFEBRILE	170	76
16	AFEBRILE	170	92
16	AFEBRILE	172	92
16	AFEBRILE	178	70
16	AFEBRILE	170	72
16	AFEBRILE	172	82
16	AFEBRILE	170	72
16	AFEBRILE	170	88
16	AFEBRILE	171	90
16	AFEBRILE	172	86
16	AFEBRILE	165	63
16	AFEBRILE	179	88
16	AFEBRILE	169	70

16	AFEBRILE	185	86
16	AFEBRILE	175	83
16	AFEBRILE	174	81
16	AFEBRILE	177	108
16	AFEBRILE	171	87
16	AFEBRILE	178	89
16	AFEBRILE	171	75
16	AFEBRILE	178	75
16	AFEBRILE	165	69
16	AFEBRILE	178	76
16	AFEBRILE	169	75
16	AFEBRILE	173	74
16	AFEBRILE	178	78
16	AFEBRILE	176	77
16	AFEBRILE	164	72
16	AFEBRILE	170	85
16	AFEBRILE	164	75
16	AFEBRILE	173	76
16	AFEBRILE	170	78
16	AFEBRILE	165	81
16	AFEBRILE	152	82
16	AFEBRILE	165	68
16	AFEBRILE	176	69
16	AFEBRILE	165	73
16	AFEBRILE	168	82
16	AFEBRILE	173	72
16	AFEBRILE	176	78
16	AFEBRILE	173	86
16	AFEBRILE	168	78
16	AFEBRILE	171	71
16	AFEBRILE	168	73
16	AFEBRILE	174	87
16	AFEBRILE	180	87
16	AFEBRILE	171	79
16	AFEBRILE	168	84
16	AFEBRILE	170	92
16	AFEBRILE	167	72
16	AFEBRILE	168	74
16	AFEBRILE	183	98
16	AFEBRILE	171	76
16	AFEBRILE	167	78
16	AFEBRILE	162	77
16	AFEBRILE	169	108
16	AFEBRILE	177	80
16	AFEBRILE	176	132
16	AFEBRILE	168	67
16	AFEBRILE	168	68
16	AFEBRILE	175	74
16	AFEBRILE	180	78
16	AFEBRILE	175	74

16	AFEBRILE	175	94
16	AFEBRILE	176	80
16	AFEBRILE	180	92
16	AFEBRILE	179	78
16	AFEBRILE	158	88
16	AFEBRILE	158	88
16	AFEBRILE	170	100
16	AFEBRILE	170	90
16	AFEBRILE	168	78
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	88
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	166	88
16	AFEBRILE	153	89
16	AFEBRILE	160	73
16	AFEBRILE	154	76
16	AFEBRILE	162	80
16	AFEBRILE	164	70
16	AFEBRILE	148	62
16	AFEBRILE	157	70
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	158	85
16	AFEBRILE	163	100
16	AFEBRILE	170	99
16	AFEBRILE	170	90
16	AFEBRILE	168	90
16	AFEBRILE	170	90
16	AFEBRILE	168	90
16	AFEBRILE	168	68
16	AFEBRILE	172	94
16	AFEBRILE	168	88
16	AFEBRILE	170	90
16	AFEBRILE	170	72
16	AFEBRILE	170	74
16	AFEBRILE	174	76
16	AFEBRILE	172	98
16	AFEBRILE	172	90
16	AFEBRILE	172	90
16	AFEBRILE	170	72
16	AFEBRILE	178	74

16	AFEBRILE	170	90
16	AFEBRILE	170	74
16	AFEBRILE	170	90
16	AFEBRILE	159	68
16	AFEBRILE	168	68
16	AFEBRILE	174	95
16	AFEBRILE	170	88
16	AFEBRILE	168	90
16	AFEBRILE	168	90
16	AFEBRILE	168	68
16	AFEBRILE	168	68
16	AFEBRILE	170	66
16	AFEBRILE	158	88
16	AFEBRILE	170	90
16	AFEBRILE	170	90
16	AFEBRILE	170	90
16	AFEBRILE	170	90
16	AFEBRILE	170	96
16	AFEBRILE	168	90
16	AFEBRILE	154	75
16	AFEBRILE	148	60
16	AFEBRILE	154	69
16	AFEBRILE	168	75
16	AFEBRILE	165	98
16	AFEBRILE	160	85
16	AFEBRILE	167	65
16	AFEBRILE	158	60
16	AFEBRILE	160	63
16	AFEBRILE	159	97
16	AFEBRILE	162	101
16	AFEBRILE	155	73
16	AFEBRILE	157	69
16	AFEBRILE	148	70
16	AFEBRILE	159	80
16	AFEBRILE	156	70
16	AFEBRILE	143	61
16	AFEBRILE	142	67
16	AFEBRILE	155	70
16	AFEBRILE	154	52
16	AFEBRILE	152	64
16	AFEBRILE	154	72
16	AFEBRILE	157	72
16	AFEBRILE	159	97
16	AFEBRILE	159	61
16	AFEBRILE	154	62
16	AFEBRILE	157	67
16	AFEBRILE	156	88
16	AFEBRILE	160	76
20	AFEBRILE	158	70
16	AFEBRILE	160	90

16	AFEBRILE	160	68

WAIST CIRCUMFERENCE (CM)	HIP CIRCUMFRANCE (CM)
98	94
92	90
96	94
88	86
88	86
88	86
88	90
72	74
80	82
80	84
84	88
88	86
88	84
86	82
84	78
88	84
84	86
70	82
80	78
76	86
90	88
88	86
68	86
86	80
76	74
90	88
64	74
68	66
56	68
64	62
86	84
68	84
86	82
66	84
68	82
66	84
82	80
100	96
100	96
68	82
70	96
88	98
88	86
68	86
66	86
68	84
88	86
88	86
66	86

68	86
66	86
68	86
100	120
64	74
78	86
86	100
88	106
98	96
78	96
92	103
86	102
90	104
90	102
116	120
90	110
68	86
68	86
90	98
88	86
88	86
76	86
88	86
76	88
88	86
114	120
84	100
78	86
74	86
70	86
96	88
88	84
88	88
88	86
68	86
70	88
88	84
88	84
68	84
70	86
66	86
70	88
72	86
80	84
78	94
72	88
88	86
74	88
90	88
90	88

76	88
90	88
74	86
72	88
74	88
70	88
80	86
78	88
90	88
90	88
74	86
76	86
72	86
70	84
96	88
88	86
88	90
90	92
82	88
78	88
76	88
75	86
72	86
74	88
76	86
78	88
88	86
72	90
88	86
88	86
76	86
76	86
88	84
78	88
88	88
90	84
78	88
76	88
90	88
90	88
78	86
76	86
80	96
72	90
72	96
90	88
100	110
80	96
90	100
100	114

96	110
90	104
98	100
118	116
96	106
90	106
90	102
98	100
96	98
96	108
97	100
90	103
100	112
90	98
90	100
96	112
86	100
96	102
98	100
110	112
102	92
90	96
90	98
98	94
104	90
104	110
98	94
110	98
108	98
98	100
94	98
102	102
102	96
96	90
110	110
102	104
94	104
92	100
98	104
96	100
94	102
100	98
122	120
96	104
128	126
94	96
100	104
100	112
98	108
100	98

106	106
98	80
106	102
86	98
98	96
86	88
86	90
86	84
76	78
84	86
84	86
84	82
78	76
84	86
88	86
86	86
106	104
94	110
106	100
108	116
96	114
100	102
98	100
100	102
84	86
86	88
88	90
86	88
88	90
86	88
84	86
98	96
98	96
116	120
90	88
88	86
88	86
88	86
82	88
90	88
86	84
88	86
86	90
86	88
88	90
90	88
90	88
88	86
88	90
90	92

90	88
88	90
88	86
90	92
86	88
90	88
90	88
90	88
88	86
86	88
84	88
86	88
84	82
88	86
92	90
90	88
90	88
92	90
90	88
106	102
92	100
106	102
96	98
122	112
98	96
114	118
94	104
100	106
128	126
124	116
106	100
102	92
94	84
112	110
96	94
108	100
106	98
96	90
84	94
100	92
100	96
100	98
130	114
94	98
104	98
88	80
92	88
88	90
88	90
92	88

88	90

BODY MASS INDEX (KG/M2)	WAIST HIP RATIO	PALLOR	CYNOSIS
35.1	1.04	A	A
31.1	1.02	A	A
31.1	1.02	A	A
36	1.02	A	A
36.8	1.02	A	A
36.7	1.02	A	A
26.7	0.9	A	A
26.4	0.9	A	A
25.2	0.9	A	A
26.1	0.9	A	A
27.2	0.9	A	A
36	1.02	A	A
35.1	1.04	A	A
31.8	1.04	A	A
35.6	1.07	A	A
30.4	1.04	A	A
24.2	0.9	A	A
24.8	0.8	A	A
31.1	1.02	A	A
21.9	0.8	A	A
31.1	0.9	A	A
31.8	1.02	A	A
22.4	0.7	A	A
31.1	1.07	A	A
30.4	1.07	A	A
33.9	1.02	A	A
22.8	0.86	A	A
22.6	0.9	A	A
22.6	0.8	A	A
29	1.03	A	A
31.1	1.02	A	A
24	0.8	A	A
31.8	1.04	A	A
24	0.7	A	A
31.8	0.8	A	A
23.3	0.7	A	A
32.5	1.02	A	A
27.9	1.04	A	A
28.3	1.04	A	A
24	0.82	A	A
21.8	0.7	A	A
22.9	0.8	A	A
27	1.02	A	A
23.3	0.7	A	A
24	0.7	A	A
23.3	0.8	A	A
31.8	1.02	A	A
31.8	1.02	A	A
31.1	0.7	A	A

29	0.7	A	A
31.8	0.7	A	A
30.4	0.7	A	A
32.6	0.83	A	A
23.9	0.86	A	A
22.7	0.9	A	A
27.6	0.8	A	A
26.2	0.8	A	A
30.4	1.02	A	A
22.9	0.81	A	A
27.8	0.89	A	A
25.3	0.84	A	A
28.7	0.8	A	A
26.1	0.8	A	A
27.7	0.81	A	A
25.9	0.81	A	A
23.6	0.7	A	A
27.9	0.7	A	A
23.5	0.83	A	A
31.8	1.02	A	A
31.8	1.02	A	A
31.8	0.8	A	A
31.8	1.02	A	A
31.1	0.86	A	A
31.1	1.02	A	A
41.5	0.86	A	A
24.3	0.84	A	A
31.1	0.9	A	A
23.5	0.86	A	A
22.8	0.81	A	A
31.1	1.12	A	A
31.1	1.04	A	A
31.1	1	A	A
31.1	1.02	A	A
23.5	0.79	A	A
24.2	0.79	A	A
31	1.04	A	A
31.1	1.04	A	A
23.8	0.8	A	A
24.5	0.81	A	A
24.9	0.76	A	A
24.8	0.79	A	A
24	0.83	A	A
27	0.9	A	A
27.7	0.82	A	A
27.6	0.81	A	A
29.7	1.02	A	A
26.8	0.84	A	A
29	1.02	A	A
30.4	1.02	A	A

23.5	0.86	A	A
31.8	1.02	A	A
22.8	0.86	A	A
20.9	0.81	A	A
24.2	0.84	A	A
24.2	0.79	A	A
24.3	0.93	A	A
23.5	0.88	A	A
31.1	1.02	A	A
29	1.02	A	A
27.6	0.86	A	A
24.9	0.88	A	A
22.5	0.83	A	A
23.5	0.83	A	A
31.1	1.09	A	A
19.2	0.9	A	A
24.2	0.9	A	A
23.5	0.97	A	A
31.1	0.93	A	A
22.9	0.88	A	A
24.2	0.86	A	A
24.9	0.87	A	A
25.5	0.82	A	A
24.2	0.84	A	A
26.4	0.88	A	A
24.09	0.88	A	A
31.1	1.02	A	A
25.5	0.8	A	A
31.1	1.02	A	A
31.2	1.02	A	A
31.1	0.88	A	A
19.4	0.88	A	A
31.1	1.04	A	A
22	0.88	A	A
28.4	1	A	A
29.7	1.07	A	A
25.1	0.88	A	A
26.2	0.86	A	A
31.8	1.02	A	A
31	1.02	A	A
22	0.9	A	A
24.9	0.88	A	A
27.7	0.83	A	A
24.9	0.8	A	A
30.4	0.75	A	A
31.1	1.02	A	A
29.06	0.9	A	A
23.1	0.83	A	A
27.4	0.9	A	A
24.5	0.87	A	A

25.1	0.87	A	A
27.1	0.86	A	A
26.7	0.98	A	A
34.4	1.01	A	A
29.9	0.9	A	A
28	0.84	A	A
25.6	0.88	A	A
23.6	0.98	A	A
25.3	0.97	A	A
23.4	0.88	A	A
26.2	0.97	A	A
24.7	0.87	A	A
24.3	0.89	A	A
24.8	0.91	A	A
26.7	0.9	A	A
29.4	0.85	A	A
27.8	0.86	A	A
25.3	0.94	A	A
26.9	0.98	A	A
29.7	0.98	A	A
35.4	1.1	A	A
24.9	0.93	A	A
24.5	0.91	A	A
26.8	1.04	A	A
29	1.1	A	A
24	0.94	A	A
25.1	1.04	A	A
28.7	1.12	A	A
27.6	1.07	A	A
24.2	0.98	A	A
25.8	0.35	A	A
28.7	1	A	A
26.8	1.06	A	A
27	1.06	A	A
29.7	1	A	A
31.8	0.9	A	A
25.8	0.9	A	A
26.2	0.92	A	A
29.2	0.94	A	A
25.9	0.9	A	A
27.9	0.92	A	A
29.3	1.02	A	A
37.8	1.01	A	A
25.5	0.9	A	A
42.6	1.01	A	A
23.7	0.97	A	A
24	0.96	A	A
24.1	0.89	A	A
24	0.9	A	A
24.1	1.02	A	A

30.6	1	A	A
25.8	1.1	A	A
28.3	1	A	A
24.34	0.8	A	A
35.2	1.02	A	A
35.2	0.9	A	A
34.6	0.9	A	A
31.1	1.02	A	A
27.6	0.97	A	A
31.8	0.97	A	A
31.8	0.97	A	A
31.8	1.02	A	A
31.8	1.02	A	A
31.7	0.9	A	A
31.8	1.02	A	A
31.8	1.02	A	A
21.7	1.02	A	A
31.9	0.97	A	A
28.5	0.97	A	A
32.04	0.97	A	A
38.1	0.97	A	A
26	0.97	A	A
28.3	0.97	A	A
28.3	0.97	A	A
31.8	0.97	A	A
31.8	0.9	A	A
31.8	0.9	A	A
31.8	0.9	A	A
31.8	0.9	A	A
31.8	0.9	A	A
31.8	0.9	A	A
34	1.02	A	A
31.6	1.02	A	A
34.2	0.96	A	A
31.1	1.02	A	A
31.8	1.02	A	A
31.1	1.02	A	A
31.8	1.02	A	A
24.09	0.93	A	A
31.7	1.02	A	A
31.1	1.02	A	A
31.1	1.02	A	A
24.9	0.9	A	A
25.6	0.9	A	A
25.1	0.9	A	A
33.1	1.02	A	A
30.4	1.02	A	A
30.4	1.02	A	A
24.9	0.9	A	A
23	0.9	A	A

31.1	1.02	A	A
25.6	0.9	A	A
31.1	1.02	A	A
26.8	0.9	A	A
24	0.9	A	A
31.3	1.02	A	A
30.4	1.02	A	A
31.8	1.02	A	A
31.8	1.02	A	A
24.09	0.9	A	A
24.09	0.9	A	A
22.8	0.9	A	A
35.2	1.02	A	A
31.1	1.02	A	A
31.1	1.02	A	A
31.1	1.02	A	A
31.1	1.02	A	A
33.2	1.02	A	A
31.8	1.02	A	A
31.6	1.03	A	A
27.3	0.9	A	A
29.09	1.02	A	A
26.5	0.9	A	A
35.9	1.01	A	A
33.2	1.01	A	A
23.3	0.96	A	A
24.03	0.9	A	A
24.6	0.94	A	A
38.3	1.01	A	A
38.4	1.06	A	A
30.3	1.06	A	A
27.9	1.1	A	A
26.2	1.1	A	A
34.1	1.01	A	A
28.7	1.02	A	A
29.8	1.08	A	A
33.2	1.08	A	A
29.1	1.06	A	A
21.9	0.8	A	A
27.7	1.08	A	A
30.3	1.04	A	A
29.2	1.02	A	A
38.3	1.14	A	A
24.1	0.95	A	A
26.1	1.06	A	A
27.1	1.1	A	A
36.1	1.08	A	A
29.6	0.9	A	A
28.04	0.9	A	A
31.1	1.04	A	A

26.5	0.97	A	A

EDEMA	CLUBBING	ICTERUS	JUGULAR VENOUS PRESSURE	CVS
A	A	A	NR	NAD
A	A	A	NR	NAD
A	A	A	NR	NAD

A	A	A	NR	NAD
A	A	A	NR	NAD
A	A	A	NR	NAD

A	A	A	NR	NAD
A	A	A	NR	NAD
A	A	A	NR	NAD

A	A	A	NR	NAD
A	A	A	NR	NAD
A	A	A	NR	NAD

A	A	A	NR	NAD
A	A	A	NR	NAD
A	A	A	NR	NAD

A	A	A	NR	NAD
A	A	A	NR	NAD
A	A	A	NR	NAD

A	A	A	NR	NAD

RESP	ABDOMEN	CNS	OLD MEDICATION
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	N
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y

NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y

NAD	NAD	NAD	N
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	N
NAD	NAD	NAD	Y

NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y

NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N

NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	N
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y
NAD	NAD	NAD	Y

NAD	NAD	NAD	Y

OLD TREATMENT RECOR DMEDICATIONS	
METFORMIN	GLIMEPRIDE
METFORMIN	
METFORMIN	
METFORMIN	
	GLYCOMET
	METFORMIN
	METFORMIN
GLIMEPRIDE	METFORMIN
GLYCOMET-GP1	
GLYCOMET-GP1	
METFORMIN	
GLYCOMET-GP1	
METFORMIN	
METFORMIN	
GLYCOMET-GP1	
GLYCOMET-GP1	
GLYCOMET-GP1	
GLYCOMET-GP1	
GLYCOMET-GP1	
METFORMIN	
GLYCOMET-GP1	
GLYCOMET-GP1	
TENEPRIDE 20	
METFORMIN	
METFORMIN	
METFORMIN	
METFORMIN	
GLYCOMET-GP1	
GLYCOMET-GP1	
GLYCOMET-GP1	
GLYCOMET-GP1	
METFORMIN	
GLYCOMET-GP1	
TENEPRIDE 20	
GLYCOMET-GP1	
METFORMIN	
GLYCOMET-GP1	
TRIPRIDE	
TRIPRIDE	
METFORMIN	
TELMA-AM	GLYCOMET
MIXTARD INSULIN	DIAPRIDE-M
METFORMIN	
	METFORMIN
METFORMIN	
	METFORMIN
GLYCOMET-GP1	
	METFORMIN
GLYCOMET-GP1	

	METFORMIN
GLYCOMET-GP1	
	METFORMIN
ZOMELISMET	
TRIPRIDE	
JANUMET	METFORMIN
GALVASMET	AMCARD-AT
METFORMIN	JANUMET
	METFORMIN
JANUMET	
DIAPRIDE	
	METFORMIN
GLIMCOR M2	
	INSULIN
TRIPRIDE	
	INSULIN
AMARYL-M	AMLODIPINE
DIAPRIDE	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	
DIAPRIDE	
	METFORMIN
DIAPRIDE	
	METFORMIN
METFORMIN	
	METFORMIN
GLYCOMET-GP1	
METFORMIN	
	METFORMIN
	METFORMIN
GLYCOMET	
	METFORMIN
METFORMIN	
METFORMIN	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	
	GLYCOMET
GLYCOMET	
	DIAPRIDE-M
GLYCOMET	
	GLYCOMET
METFORMIN	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	

	GLYCOMET
	GLYCOMET
JANUMET	
	METFORMIN
METFORMIN	
	GLYCOMET
METFORMIN	
	METFORMIN
	METFORMIN
METFORMIN	
	METFORMIN
DIAPRIDE	
	METFORMIN
GLYCOMET	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	
	METFORMIN
GLYCOMET	
	METFORMIN
DIAPRIDE	
	METFORMIN
GLYCOMET	
	GLYCOMET
GLYCOMET	
	GLYCOMET
GLYCOMET	
	GLYCOMET
GLYCOMET	
	TENEPRIDE
TENEPRIDE 20	
	TENEPRIDE
GLYCOMET	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	
	METFORMIN
GLYCOMET GP1	
	METFORMIN
METFORMIN	
	JANUMET
METFORMIN	
	DIAPRIDE-M
METFORMIN	

	GLYCOMET
GLYCOMET	
	METFORMIN
GLYCOMET	
	GLYCOMET
SITAGLIPTIN	
	JANUMET
TRIPRIDE	
	METFORMIN
TRIPRIDE	
	DIAPRIDE-M
JARDIANCE	
	METFORMIN
GLYCOMET	
	GLYCOMET
METFORMIN	
	DIAPRIDE-M
DIAPRIDE	
	GLYCOMET
GLYCOMET	
	DIANORM
DIANORM	
	GLYCOMET
MELMET SR	
	GLYCOMET
GLYCOMET	
TENEPRIDE 20	GLYCOMET
	METFORMIN
GLYCOMET	
	GLYCOMET
METFORMIN	
	METFORMIN
GLYCOMET SR	
	GLYCOMET
DIAPRIDE	
	GLYCOMET
METFORMIN	
	METFORMIN
MELMET SR	
GLIMEPRIDE	METFORMIN
	METFORMIN
ECOSPRIN GOLD	DIAPRODE
	METFORMIN
ZORYL-M	TENEGLIPTIN
GLYCOMET	NEBICARD
	GLYCOMET
TENEPRIDE 20	
	JANUMET
GLYCOMET	TENEPRIDE
GLYCOMET	

	METFORMIN
GLIMESTAR	
GLUCONORM	TENEPRIDE
	GLUCONORM
JANUMET	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	
	GLYCOMET
METFORMIN	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	
	DIAPRIDE-M
GLYCOMET	
	GLYCIPHAGE
GLIMISTAR	
	DIAPRIDE-M
METFORMIN	
JARDIANCE	GLIMISAVE
	METFORMIN
GLYCOMET	
	SITAGLIPTIN
METFORMIN	
	DIAPRIDE-M
TENEPRIDE 20	
	DIAPRIDE-M
METFORMIN	
	METFORMIN
MIXTARD INSULIN	
	GLIPIZIDE
GLIMEPRIDE	
	METFORMIN
METFORMIN	
	JANUMET
GLUCYCOMET-GP1	
	GLYCOMET-GP1
GLYCOMET-GP1	
	GLYCOMET
METFORMIN	
	METFORMIN
GLYCOMET	
	METFORMIN
GLYCOMET GP	
	METFORMIN
METFORMIN	
	METFORMIN
METFORMIN	

	GLYCOMET
METFORMIN	
	METFORMIN
METFORMIN	
	GLYCOMET
METFORMIN	
	GLYCOMET
METFORMIN	
	METFORMIN
GLYCOMET	
	GLIMEPRIDE
METFORMIN	
	METFORMIN
	TENEPRIDE-M
METFORMIN	
	GLYCOMET-GP1
GLYCOMET	
	METFORMIN
METFORMIN	
NONE	NONE
METFORMIN	
TENEPRIDE	DIAPRIDE
DIAPRIDE	
	METFORMIN
METFORMIN	
	GLIMI-SR
TELMA-AM	GLYCOMET-GP1
GLIMISTAR	THYRONORM
ZORYL-M	
GLYCOMET	
	GLYCOMET-GP1
GLYCOMET	
	METFORMIN
TELMA-AM	
METFORMIN	
	GPM
METFORMIN	
GLYCOMET	
ENVAS	DILZEM
GLYCOMET	
	GLYCOMET-GP1
METFORMIN	
	ZETAMET PLUS
GLYCOMET	
	NITROLONG
GLYCOMET	AMLONG
METFORMIN	
JANUVIA	METFORMIN
METFORMIN	INSULIN

METFORMIN	

WHETHER COMPLIANT (YES/ NO)	HB	TLC	PLATELET	UREA
N	8.3	8.2	183	47
N	13.5	7.3	171	30
Y	14.1	11.4	249	21
Y	10	9.8	246	37
N	12.7	7.6	198	25
N	13.8	17	233	33
N	14.3	4.5	107	19
N	14.8	9.5	237	13
Y	14	10	280	28
N	8.3	14.5	266	29
Y	10.9	13.8	190	24
N	9.8	12	370	31
Y	14	6.4	168	27
N	10.4	9.1	376	46
N	11.2	11.5	584	39
N	9.1	9.6	194	34
Y	11.8	8.5	422	24
N	13.7	8.5	410	24
N	11	7.9	270	20
N	12	10	270	13
N	14.2	7	199	44
N	12.2	14	290	23
N	12.3	16	236	35
N	14.9	2.5	178	19
N	16.9	15	320	24
N	14	11.8	309	18
Y	13	5.9	274	24
Y	11.5	6	277	59
N	14.9	11.5	144	17
N	14.7	7.7	200	53
N	14.7	11.7	316	38
N	13.3	6.3	243	48
N	11.5	4.5	290	27
Y	11	4.8	270	16
Y	12.7	9.4	212	15
Y	12.9	7.5	250	45
N	11	5.6	290	40
Y	13.2	4.9	177	36
Y	12.2	5.5	188	26
Y	8.8	6.1	448	39
Y	12.8	6.5	292	24
Y	13.5	8.5	228	24
N	12.8	6.5	253	24
N	12.6	6.1	145	24
N	12	8.6	155	24
N	10.8	10	258	24
N	12	4.5	250	24
N	15.9	9.9	194	24
N	13.9	4.5	196	24

N	12	6.6	250	24
N	12	8.6	250	18
N	10.3	6.6	188	17
Y	13.3	8.7	324	24
Y	13.5	8.5	228	24
Y	13.6	7.8	237	40
N	15.3	11.4	360	28
Y	9.2	2.6	451	28
Y	12.5	9.2	459	24
N	14.6	6.6	198	24
Y	14.3	7.4	232	24
Y	14.5	6.3	155	24
Y	16.5	8	325	24
Y	12.8	5.3	198	24
Y	12.6	10.3	206	24
Y	12.9	8.6	275	24
Y	13.6	5.4	235	40
Y	13.4	7.8	169	24
N	12.5	5.7	154	24
Y	12	6.5	250	15
Y	12.6	9	258	46
N	8.4	12.1	455	26
Y	8.8	10	250	12
N	16.6	7.3	195	24
Y	13.4	6.1	263	42
Y	13.5	10.9	298	24
Y	15.2	10	289	24
Y	15.2	7.2	394	42
Y	13.8	9.7	216	24
N	14	6.6	259	24
N	13.6	6.3	210	26
N	12.4	10	250	24
Y	12	10	250	27
N	14.7	6.1	182	25
N	12	10	250	26
N	12	10	250	19
N	12	9	250	24
N	10.5	8	250	47
Y	11	6.7	213	13
N	12.8	11.6	250	35
N	11.3	9.1	233	24
N	12.5	7.9	182	24
N	12	10	250	24
N	11	8	244	24
N	12.5	5.8	258	24
N	13.5	5.6	180	16
N	12.5	8.5	210	42
N	14	8.7	241	24
N	13	7.8	348	37
N	12	10	258	38

N	11.5	7	264	25
N	13.7	10.9	250	52
N	14	4.2	250	24
N	16.7	4.1	321	42
Y	16	4.2	250	29
N	14.8	4.5	250	30
N	12	4.5	258	24
N	14	7.8	250	24
N	13	4.8	250	32
N	14	4.8	250	40
N	14	4.8	258	18
N	14	4.8	250	40
Y	14.8	4.8	208	24
N	12	7.8	250	24
N	12	10.9	250	24
N	12	5	250	24
N	13.5	7.2	150	24
N	14.4	13	204	24
N	10.2	11.7	258	26
N	12	8.5	282	24
N	11.3	9.1	233	31
N	12.5	7.9	182	24
N	12	10	155	44
N	14.6	5.8	250	44
N	14	4.8	250	44
N	12	10	225	16
N	14	12	258	24
N	14	8.7	241	18
N	13.1	7.8	390	37
N	12.5	7.6	258	38
Y	13.3	6.3	243	48
N	14	9.3	250	40
N	12	10	158	28
N	12	10	250	24
N	12	4.5	250	40
N	10.6	12.4	308	24
N	10	12	250	40
N	12	5.8	250	40
N	9.6	13.2	250	17
N	13.3	14	244	37
N	12	10	524	28
N	12	10	250	40
N	14.3	8.7	182	37
N	11	10	168	40
N	10	10	150	40
N	13.7	5.7	169	40
N	12.1	9.5	232	40
N	13	5.7	150	40
Y	16	6	210	40
Y	13.6	6.5	150	40

N	16	4.5	194	20
N	12.4	5.6	214	24
N	7.9	5.6	140	24
Y	14	5.6	150	14
Y	15.3	6.8	174	24
Y	15.2	6.7	262	20
Y	14.1	6.7	291	20
Y	13.5	6.9	213	20
Y	14.3	6.8	200	40
Y	15.5	6.4	150	24
Y	15.5	8.3	238	20
Y	13.3	4	140	40
Y	16.9	8	200	20
N	13.6	7.7	166	16
Y	13.5	5.8	90	24
Y	14.8	7.8	236	24
Y	12	6.8	248	222
Y	12	5.6	152	24
N	14	7	153	24
N	12	5.6	150	24
Y	12.2	13.3	329	24
Y	13.9	7.3	235	24
N	13.9	7.7	230	24
Y	12	5.6	130	24
Y	15.7	9.6	269	24
N	13.3	9.4	269	18
N	12.4	8.3	317	24
N	13.4	6.7	150	24
N	15.9	4.5	140	24
Y	13.9	9.3	203	24
N	12.4	14.7	329	24
N	15.6	8.1	250	24
N	12	10	158	24
N	13.5	8.5	158	24
N	12	10	158	24
N	12	12	158	24
N	15	7.6	424	21
N	12	10	250	24
N	15.4	12	204	40
Y	12	4.5	258	24
N	11.8	7.1	376	24
Y	15	9	415	34
Y	15	10	250	24
Y	17.4	8.7	207	24
Y	14.8	8.8	261	24
N	15	6.2	252	24
N	16	6.7	173	24
N	14.7	5.5	236	24
N	13	4.5	120	24
Y	10	4.5	250	24

N	15	7.9	213	24
N	13.6	7.8	195	24
N	13	6.2	258	24
N	15.1	6.9	208	24
N	12	10	306	38
Y	10.6	12.1	150	30
N	12	6	250	26
N	14.6	13.6	362	38
N	13.8	8.2	298	24
N	11.4	7.5	290	27
N	13.3	6.3	243	48
N	14.2	15.3	285	23
N	12	10	250	42
N	11.9	16	293	24
Y	9.9	10.6	258	17
N	12	10	250	24
Y	13.3	5.6	250	24
Y	12.4	8.4	150	24
Y	9.6	8.7	277	24
N	7.8	8	363	24
N	13	12.5	236	24
N	11.9	8.9	297	24
Y	11.1	8.5	498	24
N	14.8	7.7	242	24
Y	11.1	8.9	216	31
N	12	10	250	24
N	9.6	8.3	208	28
Y	13.3	8.9	120	16
Y	11.3	22	130	45
Y	12	10	250	24
Y	12.5	4.9	198	24
Y	8.9	11.7	209	47
N	12.4	7	182	24
Y	13.2	9.4	140	24
N	11	12.4	518	18
N	11.5	12.1	590	24
N	7.9	9.1	220	20
N	9.2	14.6	557	13
N	12	10	250	26
Y	12.8	12	265	37
Y	12	10	220	40
Y	12	10	250	55
N	12	10	250	24
N	12	8	180	26
Y	12	11	250	44
N	12	10	250	38
Y	14	10	250	20
Y	13	5.8	226	33
Y	14	6	228	48
N	12	10	230	40

N	14	4.8	250	27
N	14	7.8	250	24
N	14	4.8	250	35
N	8.1	10	258	40
N	12	4.5	250	24
N	12	4.8	150	10
N	12	8.6	258	24
N	12.3	10.6	306	40
N	8.9	16.5	141	27
Y	14	4.8	250	24
N	9.4	10.5	610	27
N	12	10	250	44
N	12.8	8.6	269	43
N	7.4	8.7	250	38
N	14	4.8	250	20
N	10.1	11.4	258	33
N	10.1	12.6	670	32
N	12	16	238	40
N	12	14	250	40
N	12	5.6	150	40
N	12.4	6.5	294	40
Y	12.7	8.8	291	24
Y	13	5.6	166	24
Y	12.8	6	213	24
N	9.3	6.3	204	24
Y	13.5	7.8	341	24
Y	10.4	3.6	140	40
Y	9.6	8.7	277	20
Y	11	10.1	146	24
N	12.1	7.2	283	24
N	12.7	8.7	257	24
N	11	5.8	120	24
Y	12	5.6	337	24
N	13	9.5	431	24
Y	13.5	7.1	248	24
Y	11.3	8.6	150	24
Y	11.3	12	250	24
N	13	5.7	168	24
Y	12	8.4	153	24
Y	13.6	7.6	205	24
Y	13.9	8.6	165	24
N	10.3	5.4	229	21
Y	13.6	10	150	21
Y	11.1	5.8	158	22
N	11.3	6.4	214	24
Y	10.7	5.9	283	24
Y	15	12.8	400	38
Y	9.8	15	287	42
Y	9.2	8.8	449	17
Y	8.7	9.3	275	64

N	8.1	15.1	251	50

CREATININE	SODIUM	POTASSIUM	FBS	PPBS	SGOT
0.6	133	4.1	110	137	20
0.65	137	4.1	160	360	18
0.5	139	4	136	176	35
1	133	4.7	158	295	20
0.89	132	4.9	180	239	55
0.6	131	4.2	250	272	63
1	135	4.3	148	354	39
0.86	138	4	113	247	39
0.6	139	4.3	247	284	18
0.6	142	4.2	161	260	20
0.92	135	4.6	180	235	28
1.05	134	4.8	171	250	132
0.98	133	4.4	150	183	22
1.09	132	3.8	180	237	35
0.44	133	4.7	300	727	40
0.7	135	4.5	190	290	33
0.72	138	4.2	158	258	20
1	135	4.2	144	254	22
0.52	138	3.9	190	290	22
0.6	130	4.2	140	208	24
0.82	137	4.9	276	312	24
0.61	138	3.7	147	197	113
1	129	4.5	180	302	47
0.69	136	3.5	150	220	17
0.69	135	4.2	160	218	40
0.74	136	4.2	160	233	61
0.91	135	4.2	144	465	27
1.1	133	5	118	228	24
0.81	139	5.4	159	311	44
0.8	132	4.4	194	230	24
0.97	137	4.6	240	190	45
0.7	126	4.4	120	190	24
0.8	142	4.7	190	200	44
0.65	137	4.6	129	160	24
0.53	131	3.9	120	190	33
0.48	134	4.1	119	219	44
0.94	135	4.5	190	250	44
0.86	135	4.9	187	277	18
0.68	135	4.5	188	260	20
0.8	125	4.9	151	161	23
0.77	135	4.2	174	238	16
0.8	135	4.2	159	215	27
0.68	135	4.2	220	275	24
0.67	135	4.2	189	210	34
0.68	135	4.2	198	242	40
0.92	135	4.2	90	203	26
0.92	135	4.2	251	249	18
0.79	134	4.2	227	358	24
0.63	135	4.2	152	179	24

0.6	135	4.2	172	224	24
0.8	135	4.2	176	231	14
0.83	134	5	176	210	21
0.85	135	4.2	171	245	24
0.84	135	4.2	159	215	24
0.58	135	4.2	143	188	15
0.66	135	4.5	148	201	24
0.96	135	4.2	194	336	46
0.69	135	4.2	104	163	20
0.7	135	3.5	145	177	18
0.63	135	4.2	157	211	23
0.78	135	4.2	199	194	29
0.87	135	4.2	183	246	28
0.89	135	4.2	302	351	19
0.64	135	4.2	107	180	18
0.9	145	4.2	129	219	21
0.89	135	4.2	112	174	24
0.69	135	4.5	190	259	41
0.47	135	4.2	166	150	81
0.74	135	3.6	136	147	24
0.87	136	4.5	176	276	24
0.74	135	3.1	110	210	58
0.81	139	3.1	136	196	51
0.75	135	4.2	102	197	28
0.8	135	4.2	101	93	22
0.86	135	4.9	261	271	24
0.79	135	4.2	237	257	14
0.8	135	4.2	125	165	22
0.87	135	4.2	141	189	21
0.7	135	4.2	145	177	18
0.9	135	4.2	209	238	40
0.67	145	4.5	234	208	24
0.56	137	4.3	156	206	30
0.6	141	3.8	109	260	24
0.9	140	4.6	136	228	24
0.74	141	3.4	150	220	22
0.68	135	4.5	106	206	24
1.1	135	3.5	146	226	98
0.63	137	3.8	146	236	24
0.5	139	3.6	167	207	24
0.32	136	4.6	136	216	20
0.85	135	4.7	134	168	24
0.72	135	5.5	126	215	24
0.75	135	4.7	130	193	35
0.68	135	4.7	121	89	28
0.61	135	3.7	158	258	24
0.87	135	4.2	198	234	22
0.75	135	4.7	108	180	24
0.8	135	4.4	208	245	21
0.84	137	3.8	242	208	24

0.77	136	4.5	150	205	24
0.86	136	4.2	126	342	24
0.7	135	4.2	175	205	24
0.76	135	4.2	194	205	46
0.72	144	4.3	176	224	25
0.72	137	3.6	152	254	24
0.5	138	4.7	237	234	53
0.6	145	4.5	204	283	24
0.77	134	4.4	121	222	24
0.69	135	4.2	102	210	56
0.96	138	3.4	104	168	22
0.75	135	4.2	116	185	24
0.9	135	4.2	128	228	24
0.56	135	4.2	110	152	48
0.63	135	4.2	150	248	48
0.67	135	4.7	179	250	44
0.64	135	4.2	104	204	68
0.91	140	4.4	136	160	24
0.75	135	4.7	128	208	46
0.59	135	4.2	128	278	24
0.49	136	4.4	160	262	24
0.85	140	3.5	134	168	24
0.72	145	4.5	126	215	44
0.68	145	4.2	130	193	45
0.59	145	4.5	121	220	24
0.61	135	3.7	107	128	24
0.87	135	4.2	126	234	24
0.7	137	4.1	144	210	24
0.8	137	4.3	150	245	44
0.84	137	3.8	297	146	18
0.7	126	4.4	146	206	24
0.63	135	4.8	170	227	24
0.9	135	4.5	124	206	91
0.5	135	4.5	126	177	24
0.7	145	4.5	274	339	40
0.72	133	3.9	155	239	24
0.7	135	4.5	143	284	20
0.64	135	4.5	136	213	40
0.5	138	3.8	188	208	24
0.81	139	5	150	225	27
0.5	135	3.5	155	134	24
0.6	132	4.5	164	145	24
0.79	137	3.7	201	243	20
0.8	135	4.5	264	370	40
0.8	135	4.5	120	250	67
0.77	140	4.5	287	99	23
0.89	135	4.2	115	201	17
0.79	140	4.2	217	249	20
0.82	140	4.4	101	200	43
1.09	140	4.2	116	210	43

0.63	145	4.5	174	348	40
0.63	140	4.5	158	200	20
0.63	140	4.5	165	238	24
0.62	140	4.5	113	181	40
1	140	4.5	203	274	31
1	145	3.5	178	201	28
0.87	145	3.5	140	176	20
1.2	135	4.5	213	283	19
0.8	145	4.5	219	311	22
0.72	135	3.5	154	222	27
1	135	4.5	161	287	36
0.92	135	4.5	166	239	166
0.58	140	4.5	150	250	43
0.72	143	3.8	134	192	24
1.2	140	4.5	121	374	24
0.74	140	4.5	143	169	40
0.75	140	4.5	129	163	29
0.78	145	4.5	199	194	24
0.73	146	5	150	250	17
1	145	4.5	197	271	40
0.6	145	4.5	111	200	13
0.7	145	4.5	150	250	20
0.77	145	4.5	124	213	24
0.8	140	4.5	189	270	24
0.76	140	4.5	300	391	24
0.8	135	4.3	176	231	14
0.74	140	3.5	249	307	40
1	145	4.5	111	157	42
0.8	140	4.5	240	122	
0.6	140	4.5	192	322	40
0.5	140	4.5	150	204	22
0.74	145	4.5	175	152	80
0.6	135	4.5	158	232	24
0.86	145	4.5	207	274	24
0.96	145	4.5	303	405	16
0.6	146	4.5	273	269	24
1	149	4.5	88	149	24
0.71	145	3.5	147	227	25
0.86	145	4.5	150	250	40
0.52	145	4.5	155	217	44
0.5	145	4.5	160	221	21
0.8	135	4.5	231	281	45
1.1	145	4.5	157	196	24
0.7	145	4.5	253	300	15
0.61	145	4.5	178	253	18
0.62	145	4.5	175	272	19
0.5	145	4.5	156	229	17
0.83	145	4.5	181	189	27
0.95	145	4.5	256	374	27
1.03	145	4.5	124	174	40

0.95	145	4.5	129	139	19
0.94	145	4.5	175	187	45
0.5	145	4.5	162	360	40
0.79	140	4.5	125	356	30
1.01	139	4.6	150	185	18
0.65	145	4	140	297	19
0.6	135	4.2	150	190	22
0.65	137	4.1	190	290	44
0.64	135	4.2	113	190	22
0.65	146	3.1	269	300	44
0.7	126	4.4	120	190	24
0.53	135	4.8	240	230	15
0.51	142	3.9	171	210	144
0.64	141	4.1	194	294	24
0.32	135	4	198	202	24
0.65	135	4.2	270	293	16
0.62	135	4.2	179	243	44
0.56	145	4.5	127	388	25
0.24	135	4.2	194	284	25
0.34	145	4.2	146	145	18
0.66	135	4.2	270	318	12
0.47	135	4.2	176	225	14
0.5	135	4.2	153	432	27
0.63	135	4.2	200	250	22
0.71	136	4.6	146	246	17
0.5	135	4.2	196	288	35
0.64	138	3.6	250	250	21
0.62	137	4.4	208	394	174
1.9	143	4.2	220	315	25
0.57	135	4.2	128	160	29
0.55	135	4.2	196	288	35
0.6	137	4.1	283	188	40
0.65	135	4.2	125	198	46
0.6	135	4.2	209	237	57
0.55	130	4	185	197	21
0.9	134	4	116	288	32
0.89	141	4.2	240	204	30
0.56	132	3.6	197	282	21
0.68	136	4.3	150	250	24
0.54	137	4.3	110	114	24
0.71	137	4.4	167	229	20
1.03	137	4.6	250	250	24
0.56	135	4.7	148	480	20
0.6	137	3.9	138	216	20
0.5	145	3.9	198	449	24
0.5	134	4.3	250	300	24
0.8	147	3.8	136	206	24
0.5	136	4.5	215	262	20
0.7	130	4.7	140	220	24
0.7	135	4.7	130	208	24

0.68	135	4.7	160	250	24
0.6	145	4.5	204	283	24
0.6	134	4.2	148	218	24
0.41	135	4.2	130	469	97
0.5	135	4.2	106	206	40
0.55	135	4.2	180	254	56
0.43	135	4.7	158	218	24
0.71	137	4.4	147	229	40
0.81	136	4.9	192	185	14
0.55	135	4.5	148	480	23
0.67	137	3.9	180	325	24
0.5	142	2.7	130	276	24
0.93	137	4.8	117	276	30
0.5	134	4.3	227	400	24
0.8	147	3.8	150	250	98
0.5	136	4.5	215	244	24
0.5	131	4.2	108	207	24
0.71	135	3.5	155	209	24
1	135	4.5	158	218	40
0.78	135	4.5	239	375	26
0.77	140	4.9	130	261	24
0.74	140	3.5	127	182	24
0.85	140	4.5	194	466	24
0.47	140	4.5	120	147	24
1.07	140	4.5	278	239	24
0.43	145	4.5	181	253	41
0.87	145	4.5	134	211	40
0.72	135	4.5	194	284	25
0.57	140	4.5	175	182	24
0.8	145	4.5	176	183	24
0.76	145	4.5	220	301	21
0.64	145	4.5	348	408	15
0.62	145	4.5	231	153	24
0.7	145	4.5	150	250	20
0.82	145	4.4	148	145	24
1.02	136	5	146	250	24
0.59	145	4.5	99	129	20
0.61	141	4.5	328	380	17
0.8	145	4.5	106	589	40
0.66	145	4.5	267	239	42
0.97	145	4.5	121	196	53
0.5	140	3.6	142	157	26
0.5	138	4.4	237	180	48
0.5	140	4.5	255	207	40
1.08	135	5.1	214	202	40
1	145	4.5	282	201	23
1	135	4.5	268	206	46
1	134	4.2	134	208	30
0.9	135	3.8	152	208	16
1.9	137	4.3	150	283	20

0.9	135	4.2	109	241	40

SGPT	GLYCOSYLETED HEMOGLOBIN (HBA1C)	BNP	CHEST X-RAY	ECG
24	7.1		NAD	NSR
15			NAD	NSR
35			NAD	NSR
26			NAD	NSR
35			NAD	NSR
72			NAD	NSR
39			NAD	NSR
30	5.6		NAD	NSR
39	12.4		NAD	NSR
25	6.6		NAD	NSR
34	9.4		NAD	NSR
162	7.3		NAD	NSR
24	7.7		NAD	NSR
34		363	NAD	NSR
40			NAD	NSR
36		438	NAD	NSR
17	7.2		NAD	NSR
24	8.8		NAD	NSR
24	7.4	465	NAD	NSR
22	7.1		NAD	NSR
22	10.8		NAD	NSR
197	9.5		NAD	NSR
42			NAD	NSR
10			NAD	NSR
54			NAD	NSR
132	10.9		NAD	NSR
31	7.5		NAD	NSR
34	7.6		NAD	NSR
54	8.7		NAD	NSR
20	7.3	1790	NAD	NSR
46	12.8		NAD	NSR
22	6.1		NAD	NSR
40			NAD	NSR
24	11.7		NAD	NSR
43	7.7		NAD	NSR
54			NAD	NSR
40	9.2		NAD	NSR
19	11		NAD	NSR
22	10		NAD	NSR
12	7.6		NAD	NSR
17			NAD	NSR
37			NAD	NSR
22			NAD	NSR
35			NAD	NSR
40			NAD	NSR
30	6.3		NAD	NSR
22	11.2		NAD	NSR
22			NAD	NSR
22	10.8		NAD	NSR

24	7.7		NAD	NSR
21	11.2		NAD	NSR
24	6.1		NAD	NSR
23	9.3		NAD	NSR
22			NAD	NSR
18			NAD	NSR
52			NAD	NSR
51			NAD	NSR
20			NAD	NSR
34			NAD	NSR
21			NAD	NSR
38			NAD	NSR
40			NAD	NSR
23			NAD	NSR
14			NAD	NSR
22			NAD	NSR
27			NAD	NSR
57			NAD	NSR
64	6.9		NAD	NSR
22	7.3		NAD	NSR
22			NAD	NSR
90			NAD	NSR
52	8.5		NAD	NSR
26			NAD	NSR
26			NAD	NSR
26			NAD	NSR
22			NAD	NSR
25	6.3		NAD	NSR
27	10.7		NAD	NSR
34			NAD	NSR
50	7.3		NAD	NSR
20			NAD	NSR
48			NAD	NSR
20	7.2		NAD	NSR
20			NAD	NSR
22			NAD	NSR
22	8.2	276	NAD	NSR
107	12.7		NAD	NSR
20			NAD	NSR
20	8.8	2200	NAD	NSR
24	8.3		NAD	NSR
38			NAD	NSR
20	7.7		NAD	NSR
73			NAD	NSR
24	7		NAD	NSR
22	9		NAD	NSR
24			NAD	NSR
28	8.8		NAD	NSR
24	11.7		NAD	NSR
22	11.4		NAD	NSR

22			NAD	NSR
22	11.8		NAD	NSR
22			NAD	NSR
63			NAD	NSR
16	10.7		NAD	NSR
20			NAD	NSR
60			NAD	NSR
20			NAD	NSR
22	11.3		NAD	NSR
61	11.1		NAD	NSR
24	8		NAD	NSR
22	7.1		NAD	NSR
22			NAD	NSR
46			NAD	NSR
44			NAD	NSR
40	10.3		NAD	NSR
60	6.3		NAD	NSR
22	6.1		NAD	NSR
81	11.6		NAD	NSR
22	8.4		NAD	NSR
22	8.3		NAD	NSR
38			NAD	NSR
24	7.7		NAD	NSR
84			NAD	NSR
22	7		NAD	NSR
22	9		NAD	NSR
22			NAD	NSR
22	8.1		NAD	NSR
24	11.7		NAD	NSR
19	11.4		NAD	NSR
26	6.1		NAD	NSR
24	10.5		NAD	NSR
73			NAD	NSR
22	7.1		NAD	NSR
42			NAD	NSR
22			NAD	NSR
20		93	NAD	NSR
24			NAD	NSR
22			NAD	NSR
53			NAD	NSR
50	8.9		NAD	NSR
25	8.2		NAD	NSR
20	10		NAD	NSR
48			NAD	NSR
24			NAD	NSR
23			NAD	NSR
26	7.7		NAD	NSR
20	9.6		NAD	NSR
60			NAD	NSR
33			NAD	NSR

50	10.8		NAD	NSR
19			NAD	NSR
24			NAD	NSR
40			NAD	NSR
60			NAD	NSR
39	7.7		NAD	NSR
23	7.4		NAD	NSR
28			NAD	NSR
32	10.4		NAD	NSR
34	7.5		NAD	NSR
73	8.5		NAD	NSR
47	9.4		NAD	NSR
53			NAD	NSR
26			NAD	NSR
24	10.2		NAD	NSR
24			NAD	NSR
30			NAD	NSR
24	8.2	2510	NAD	NSR
23	7.6		NAD	NSR
40	8		NAD	NSR
18			NAD	NSR
21			NAD	NSR
24			NAD	NSR
19			NAD	NSR
19	10.1	499	NAD	NSR
21	13.9	1040	NAD	NSR
35			NAD	NSR
59	11.7		NAD	NSR
			NAD	NSR
24			NAD	NSR
22	7.2	1540	NAD	NSR
16	9.8	415	NAD	NSR
20	6.7	1300	NAD	NSR
20			NAD	NSR
19	9.8	498	NAD	NSR
20	10.9	814	NAD	NSR
20			NAD	NSR
39			NAD	NSR
24			NAD	NSR
40			NAD	NSR
34			NAD	NSR
46	9.2		NAD	NSR
26	8.4		NAD	NSR
			NAD	NSR
21			NAD	NSR
26			NAD	NSR
25	8.3		NAD	NSR
22			NAD	NSR
49			NAD	NSR
40			NAD	NSR

20			NAD	NSR
40			NAD	NSR
40	9.1		NAD	NSR
25			NAD	NSR
21	7.5		NAD	NSR
19	9.6		NAD	NSR
24	7.3		NAD	NSR
34			NAD	NSR
24	7.3		NAD	NSR
54			NAD	NSR
22	6.1		NAD	NSR
22	13.4		NAD	NSR
54	8.1		NAD	NSR
26	13.9		NAD	NSR
22			NAD	NSR
14			NAD	NSR
45			NAD	NSR
27			NAD	NSR
20			NAD	NSR
24			NAD	NSR
14			NAD	NSR
16			NAD	NSR
27	13.6		NAD	NSR
29			NAD	NSR
13	9.3		NAD	NSR
35	7.1		NAD	NSR
22	13.7		NAD	NSR
160	13.5		NAD	NSR
17	7		NAD	NSR
80			NAD	NSR
35	7.1		NAD	NSR
45	11.9		NAD	NSR
60	7.7		NAD	NSR
53			NAD	NSR
8			NAD	NSR
31	7.6		NAD	NSR
33	9.2		NAD	NSR
23	9.4		NAD	NSR
20			NAD	NSR
22	7.8	402	NAD	NSR
20			NAD	NSR
20	7.3		NAD	NSR
22			NAD	NSR
24			NAD	NSR
22	11		NAD	NSR
22	11.2		NAD	NSR
20	6.3		NAD	NSR
24			NAD	NSR
22	6.1		NAD	NSR
22			NAD	NSR

22	11.9		NAD	NSR
20			NAD	NSR
22			NAD	NSR
138			NAD	NSR
46	9.3	171	NAD	NSR
50			NAD	NSR
22	7.3	703	NAD	NSR
24			NAD	NSR
16	1.8		NAD	NSR
33			NAD	NSR
22			NAD	NSR
22	9.2		NAD	NSR
33	9.2		NAD	NSR
22	11.2	444	NAD	NSR
180	6.3		NAD	NSR
26			NAD	NSR
24			NAD	NSR
22			NAD	NSR
40			NAD	NSR
38			NAD	NSR
18			NAD	NSR
35			NAD	NSR
41			NAD	NSR
29			NAD	NSR
30	9.1		NAD	NSR
63			NAD	NSR
24			NAD	NSR
20			NAD	NSR
24	7.9		NAD	NSR
26			NAD	NSR
25			NAD	NSR
18	7.4	686	NAD	NSR
24			NAD	NSR
22			NAD	NSR
24			NAD	NSR
24	7.8	4040	NAD	NSR
24	7.2	2320	NAD	NSR
27			NAD	NSR
24			NAD	NSR
40			NAD	NSR
91			NAD	NSR
30	7.5		NAD	NSR
37			NAD	NSR
44			NAD	NSR
40	9.9		NAD	NSR
41			NAD	NSR
49	9.4		NAD	NSR
22	8.4		NAD	NSR
9			NAD	NSR
25	7.8	675	NAD	NSR

24			NAD	NSR

ECHOCARDIOGRAPHY_AORTIC ROOT	ORTIC ROOT GROU	LEFT ATRIUM
26	0	31
29	0	45
29	0	35
27	0	39
28	0	42
30	1	42
28	0	30
28	0	31
29	0	36
28	0	34
25	0	37
29	0	32
31	1	37
26	0	36
30	1	39
28	0	46
32	1	39
27	0	35
33	1	42
31	1	38
32	1	34
29	0	33
25	0	33
29	0	37
23	0	34
29	0	43
28	0	32
28	0	34
29	0	33
27	0	33
29	0	33
32	1	35
35	1	34
38	1	33
28	0	37
27	0	36
28	0	34
29	0	38
31	1	40
25	0	30
26	0	39
27	0	36
28	0	40
25	0	26
26	0	35
26	0	27
30	1	37
30	1	39
28	0	35

35	1	35
29	0	35
30	1	41
27	0	34
28	0	30
27	0	40
26	0	38
28	0	49
29	0	33
32	1	35
28	0	42
28	0	34
33	1	35
33	1	48
26	0	38
30	1	42
32	1	33
29	0	36
28	0	45
27	0	30
27	0	37
29	0	30
26	0	40
24	0	35
27	0	43
27	0	43
27	0	36
27	0	42
27	0	31
32	1	35
26	0	35
34	1	43
30	1	48
39	1	40
33	1	38
29	0	35
29	0	44
27	0	30
28	0	34
30	1	36
28	0	36
30	1	32
39	1	43
25	0	36
28	0	34
28	0	32
27	0	42
28	0	34
30	1	43
25	0	39

28	0	31
31	1	34
28	0	22
29	0	40
21	0	31
23	0	36
27	0	39
25	0	40
27	0	37
28	0	49
28	0	34
28	0	34
27	0	40
31	1	39
32	1	51
28	0	34
32	1	39
28	0	43
29	0	33
28	0	33
28	0	36
30	1	32
39	1	43
25	0	36
28	0	34
28	0	32
27	0	42
28	0	34
30	1	43
25	0	39
32	1	35
26	0	33
32	1	35
28	0	34
28	0	34
32	1	54
27	0	35
24	0	35
32	1	33
26	0	30
38	1	40
27	0	36
34	1	33
29	0	37
25	0	33
40	1	43
33	1	38
28	0	33
34	1	36
28	0	41

28	0	35
29	0	40
21	0	43
23	0	39
34	1	40
37	1	40
25	0	33
28	0	37
27	0	32
24	0	35
28	0	34
32	1	46
33	1	36
28	0	30
31	1	39
28	0	38
27	0	32
25	0	53
28	0	32
27	0	32
28	0	43
25	0	30
30	1	33
28	0	35
35	1	42
24	0	44
27	0	31
28	0	40
35	1	44
33	1	40
28	0	34
25	0	45
26	0	40
27	0	36
26	0	32
26	0	42
31	1	39
33	1	34
28	0	34
27	0	30
35	1	42
28	0	32
28	0	36
23	0	34
32	1	44
26	0	32
33	1	38
28	0	40
34	1	37
35	1	42

24	0	35
34	1	35
39	1	33
36	1	40
27	0	39
25	0	34
23	0	28
28	0	52
23	0	28
22	0	55
32	1	35
25	0	31
33	1	42
26	0	30
23	0	42
24	0	29
32	1	40
29	0	34
26	0	33
25	0	30
25	0	32
31	1	28
26	0	37
21	0	31
28	0	34
29	0	35
28	0	32
32	1	33
28	0	34
28	0	34
29	0	35
26	0	35
31	1	34
24	0	34
30	1	32
26	0	27
26	0	33
25	0	42
26	0	32
23	0	35
32	1	34
26	0	45
28	0	34
28	0	40
24	0	28
28	0	42
26	0	37
24	0	42
32	1	35
28	0	34

25	0	42
25	0	40
28	0	44
28	0	34
28	0	60
24	0	28
25	0	34
32	1	34
27	0	42
28	0	34
28	0	40
24	0	28
29	0	42
28	0	42
26	0	37
24	0	42
28	0	34
26	0	53
28	0	42
26	0	34
28	0	32
28	0	34
19	0	25
29	0	33
23	0	40
24	0	40
26	0	34
26	0	33
26	0	39
34	1	43
29	0	32
29	0	42
20	0	46
28	0	41
22	0	30
28	0	33
26	0	49
25	0	31
26	0	28
36	1	43
24	0	38
28	0	42
28	0	34
36	1	36
25	0	39
28	0	42
27	0	42
25	0	42
28	0	30
27	0	32

34	1	38

EFT ATRIUM GROU	RIGHT ATRIUM	IGHT ATRIUM GROU	RVID (D)	RVID (D) GROUP
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	34	1	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	32	1	34	1
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	30	1	32	1
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	25	1	30	1
1	20	0	22	0
0	25	1	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	22	0	20	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0

0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	25	1	20	0
0	22	0	25	0
1	25	1	20	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	22	0	20	0
1	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	37	1	35	1
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
1	20	0	22	0
1	28	1	40	1
0	20	0	22	0
0	20	0	22	0
1	40	1	39	1
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	26	1	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0

0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	33	1	29	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	48	1	41	1
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0

0	20	0	22	0
1	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	22	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	37	1	46	1
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	25	1	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
1	42	1	36	1
0	20	0	22	0
1	25	1	20	0
1	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	25	1	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	30	1	30	1
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0

0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	22	0	20	0
0	20	0	22	0
0	24	0	22	0
0	20	0	22	0
0	20	0	22	0
0	25	1	22	0
0	20	0	22	0
0	25	1	20	0
0	25	1	20	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	25	1	20	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	32	1	32	1
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0

1	20	0	22	0
1	20	0	22	0
1	28	1	28	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	25	1	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	42	1	27	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	22	0	22	0
0	20	0	22	0
1	20	0	22	0
1	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
1	40	1	42	1
0	22	0	20	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0
0	25	1	22	0
1	20	0	22	0
1	31	1	24	0
1	20	0	22	0
0	20	0	22	0
0	20	0	22	0

0	20	0	22	0

IVST (D)	IVST (D) GROUP	IVST (S)	VST (S) GROUP	LVID(D)	LVID(D) GROUP
10	0	11	1	48	0
12	1	18	1	50	0
8	0	9	0	54	0
10	0	11	1	40	0
13	1	15	1	45	0
13	1	18	1	55	0
9	0	14	1	42	0
9	0	10	0	48	0
9	0	10	0	46	0
13	1	14	1	46	0
9	0	10	0	30	0
12	1	13	1	45	0
3	0	4	0	60	1
9	0	10	0	59	1
10	0	12	1	56	0
8	0	10	0	62	1
9	0	10	0	48	0
14	1	16	1	49	0
8	0	9	0	65	1
12	1	13	1	49	0
11	1	12	1	41	0
13	1	15	1	57	0
10	0	12	1	27	0
12	1	15	1	47	0
12	1	13	1	43	0
6	0	7	0	52	0
12	1	14	1	33	0
9	0	10	0	46	0
13	1	15	1	42	0
11	1	12	1	53	0
13	1	14	1	48	0
8	0	12	1	45	0
15	1	19	1	43	0
8	0	10	0	45	0
12	1	15	1	47	0
10	0	12	1	32	0
12	1	14	1	48	0
8	0	9	0	50	0
11	1	12	1	40	0
8	0	10	0	44	0
10	0	12	1	40	0
12	1	13	1	46	0
9	0	10	0	52	0
9	0	11	1	37	0
14	1	15	1	52	0
10	0	14	1	57	0
8	0	12	1	60	1
14	1	16	1	57	0
8	0	10	0	49	0

12	1	14	1	41	0
13	1	18	1	46	0
12	1	15	1	43	0
12	1	13	1	49	0
10	0	10	0	44	0
13	1	14	1	40	0
12	1	13	1	46	0
14	1	16	1	58	1
13	1	14	1	48	0
9	0	44	1	32	0
15	1	18	1	52	0
13	1	15	1	45	0
12	1	13	1	47	0
9	0	10	0	56	0
12	1	13	1	48	0
14	1	16	1	46	0
9	0	10	0	48	0
12	1	13	1	42	0
14	1	15	1	45	0
11	1	12	1	42	0
12	1	15	1	38	0
9	0	10	0	49	0
12	1	13	1	50	0
12	1	15	1	48	0
12	1	13	1	48	0
10	0	11	1	50	0
13	1	15	1	45	0
12	1	14	1	42	0
9	0	11	1	49	0
9	0	10	0	44	0
12	1	14	1	46	0
14	1	17	1	50	0
11	1	13	1	51	0
10	0	13	1	64	1
12	1	14	1	37	0
9	0	10	0	49	0
5	0	6	0	69	1
12	1	15	1	61	1
9	0	10	0	46	0
9	0	10	0	46	0
9	0	10	0	46	0
9	0	10	0	46	0
20	1	25	1	47	0
9	0	10	0	46	0
9	0	10	0	46	0
9	0	10	0	49	0
10	0	11	1	62	1
9	0	10	0	46	0
9	0	11	1	49	0
13	1	14	1	57	0

9	0	10	0	46	0
10	0	14	1	53	0
9	0	10	0	46	0
15	1	16	1	42	0
12	1	14	1	46	0
9	0	10	0	46	0
12	1	15	1	34	0
14	1	17	1	52	0
8	0	9	0	54	0
11	1	13	1	59	1
12	1	14	1	48	0
9	0	10	0	46	0
11	1	13	1	44	0
15	1	17	1	41	0
13	1	15	1	60	1
9	0	10	0	46	0
14	1	14	1	46	0
9	0	10	0	48	0
9	0	11	1	48	0
9	0	11	1	38	0
9	0	10	0	46	0
9	0	10	0	46	0
20	1	25	1	47	0
9	0	10	0	46	0
9	0	10	0	46	0
9	0	10	0	49	0
10	0	11	1	62	1
9	0	10	0	46	0
9	0	11	1	49	0
13	1	14	1	57	0
8	0	12	1	45	0
10	0	12	1	44	0
19	1	20	1	41	0
9	0	10	0	46	0
9	0	11	1	76	1
15	1	17	1	64	1
13	1	14	1	44	0
7	0	11	1	53	0
8	0	10	0	71	1
11	1	12	1	66	1
12	1	15	1	45	0
9	0	12	1	45	0
10	0	14	1	50	0
10	0	12	1	30	0
11	1	13	1	43	0
12	1	15	1	50	0
15	1	16	1	52	0
8	0	9	0	49	0
10	0	12	1	45	0
9	0	12	1	49	0

8	0	10	0	49	0
11	1	12	1	43	0
11	1	12	1	45	0
11	1	12	1	39	0
10	0	12	1	44	0
9	0	10	0	48	0
9	0	10	0	46	0
9	0	10	0	46	0
8	0	9	0	44	0
9	0	11	1	47	0
11	1	13	1	41	0
12	1	13	1	52	0
13	1	15	1	48	0
9	0	10	0	40	0
14	1	17	1	40	0
12	1	13	1	38	0
9	0	11	1	45	0
8	0	11	1	67	1
12	1	14	1	36	0
12	1	13	1	50	0
12	1	14	1	45	0
11	1	14	1	55	0
12	1	14	1	49	0
9	0	10	0	74	1
13	1	16	1	58	1
5	0	6	0	61	1
12	1	13	1	44	0
11	1	13	1	43	0
13	1	15	1	46	0
9	0	10	0	56	0
8	0	11	1	49	0
13	1	14	1	52	0
12	1	13	1	48	0
12	1	13	1	40	0
6	0	8	0	59	1
7	0	8	0	54	0
12	1	13	1	42	0
9	0	10	0	48	0
13	1	17	1	46	0
11	1	12	1	34	0
15	1	17	1	42	0
11	1	12	1	40	0
13	1	15	1	53	0
9	0	10	0	46	0
13	1	17	1	49	0
9	0	10	0	48	0
12	1	13	1	51	0
9	0	10	0	53	0
13	1	14	1	50	0
9	0	10	0	46	0

14	1	16	1	41	0
12	1	14	1	39	0
13	1	15	1	54	0
8	0	12	1	42	0
12	1	14	1	47	0
9	0	10	0	46	0
10	0	14	1	53	0
12	1	15	1	47	0
10	0	14	1	53	0
14	1	16	1	47	0
8	0	12	1	45	0
12	1	14	1	39	0
9	0	11	1	42	0
12	1	14	1	32	0
12	1	14	1	56	0
11	1	12	1	38	0
13	1	14	1	44	0
11	1	12	1	40	0
8	0	10	0	47	0
8	0	10	0	44	0
11	1	14	1	45	0
11	1	15	1	46	0
9	0	13	1	46	0
11	1	14	1	44	0
8	0	10	0	40	0
12	1	15	1	40	0
8	0	10	0	38	0
6	0	7	0	37	0
8	0	9	0	52	0
12	1	14	1	37	0
12	1	15	1	40	0
12	1	15	1	49	0
12	1	14	1	45	0
12	1	15	1	49	0
9	0	11	1	44	0
12	1	15	1	32	0
12	1	13	1	45	0
7	0	8	0	51	0
12	1	14	1	40	0
6	0	7	0	60	1
8	0	9	0	53	0
7	0	8	0	58	1
11	1	14	1	30	0
9	0	10	0	46	0
9	0	10	0	44	0
13	1	14	1	53	0
8	0	9	0	48	0
14	1	17	1	42	0
8	0	12	1	45	0
9	0	10	0	46	0

10	0	12	1	46	0
14	1	17	1	52	0
8	0	9	0	50	0
12	1	14	1	31	0
9	0	10	0	46	0
10	0	12	1	51	0
10	0	11	1	47	0
8	0	9	0	53	0
10	0	12	1	44	0
11	1	14	1	30	0
9	0	10	0	46	0
9	0	10	0	44	0
13	1	14	1	52	0
13	1	14	1	53	0
8	0	9	0	48	0
14	1	17	1	42	0
12	1	14	1	38	0
20	1	25	1	51	0
12	1	14	1	48	0
15	1	16	1	47	0
9	0	10	0	40	0
10	0	11	1	39	0
9	0	10	0	33	0
12	1	13	1	34	0
13	1	15	1	49	0
12	1	13	1	48	0
9	0	10	0	45	0
8	0	10	0	47	0
12	1	13	1	53	0
11	1	13	1	48	0
12	1	16	1	33	0
15	1	16	1	38	0
13	1	14	1	43	0
13	1	14	1	46	0
13	1	16	1	39	0
6	0	7	0	72	1
8	0	9	0	66	1
13	1	16	1	37	0
10	0	12	1	36	0
12	1	13	1	49	0
22	1	24	1	39	0
12	1	14	1	40	0
14	1	15	1	33	0
9	0	10	0	41	0
8	0	9	0	46	0
9	0	11	1	44	0
13	1	15	1	39	0
10	0	12	1	50	0
13	1	15	1	45	0
9	0	10	0	58	1

9	0	10	0	52	0

LVID(S)	LVID(S) GROUP	LVPW(D)	LVPW(D) GROUP	LVPW(S)	LVPW(S) GROUP
37	0	9	0	12	1
32	0	14	1	15	1
44	1	10	0	12	1
31	0	8	0	11	1
34	0	9	0	10	0
42	1	13	1	14	1
27	0	14	1	15	1
33	0	10	0	12	1
26	0	9	0	10	0
27	0	12	1	14	1
20	0	9	0	10	0
33	0	12	1	13	1
53	1	10	0	11	1
49	1	11	1	13	1
46	1	8	0	9	0
51	1	10	0	11	1
26	0	9	0	10	0
32	0	14	1	15	1
54	1	9	0	12	1
34	0	12	1	14	1
28	0	10	0	14	1
46	1	8	0	9	0
17	0	10	0	12	1
32	0	11	1	14	1
30	0	12	1	13	1
40	1	9	0	10	0
31	0	11	1	13	1
26	0	9	0	10	0
24	0	13	1	15	1
44	1	7	0	11	1
35	0	13	1	15	1
37	0	10	0	12	1
26	0	14	1	18	1
34	0	9	0	10	0
36	0	10	0	11	1
22	0	10	0	12	1
26	0	12	1	14	1
44	1	9	0	10	0
29	0	9	0	13	1
28	0	10	0	14	1
28	0	10	0	12	1
30	0	9	0	11	1
34	0	9	0	10	0
22	0	8	0	12	1
38	0	11	1	15	1
37	0	8	0	13	1
49	1	6	0	7	0
32	0	14	1	16	1
33	0	10	0	12	1

26	0	13	1	16	1
33	0	13	1	18	1
27	0	12	1	15	1
34	0	13	1	14	1
32	0	10	0	8	0
26	0	14	1	15	1
30	0	11	1	14	1
38	0	13	1	6	0
35	0	13	1	15	1
10	0	11	1	60	1
32	0	14	1	17	1
27	0	13	1	14	1
29	0	11	1	13	1
46	1	10	0	12	1
33	0	12	1	13	1
25	0	12	1	15	1
32	0	10	0	10	0
25	0	11	1	15	1
24	0	13	1	17	1
39	1	12	1	13	1
30	0	12	1	15	1
31	0	10	0	11	1
40	1	10	0	12	1
34	0	12	1	14	1
33	0	13	1	14	1
40	1	12	1	14	1
30	0	13	1	15	1
29	0	11	1	13	1
31	0	10	0	11	1
32	0	10	0	11	1
31	0	12	1	15	1
32	0	14	1	17	1
40	1	5	0	6	0
55	1	12	1	13	1
25	0	12	1	13	1
36	0	9	0	10	0
60	1	8	0	10	0
49	1	12	1	13	1
26	0	9	0	10	0
26	0	9	0	10	0
26	0	9	0	10	0
26	0	9	0	10	0
33	0	7	0	9	0
26	0	9	0	10	0
26	0	9	0	10	0
33	0	10	0	11	1
53	1	10	0	11	1
26	0	9	0	10	0
33	0	10	0	11	1
39	1	13	1	16	1

26	0	9	0	10	0
37	0	7	0	10	0
26	0	9	0	10	0
28	0	13	1	15	1
31	0	12	1	14	1
26	0	9	0	10	0
23	0	12	1	15	1
35	0	14	1	17	1
46	1	9	0	12	1
51	1	7	0	8	0
26	0	12	1	14	1
26	0	9	0	10	0
30	0	10	0	11	1
26	0	15	1	17	1
41	1	13	1	16	1
26	0	9	0	10	0
26	0	12	1	14	1
28	0	9	0	10	0
38	0	10	0	12	1
25	0	10	0	11	1
26	0	9	0	10	0
26	0	9	0	10	0
33	0	7	0	9	0
26	0	9	0	10	0
26	0	9	0	10	0
33	0	10	0	11	1
53	1	10	0	11	1
26	0	9	0	10	0
33	0	10	0	11	1
39	1	13	1	16	1
37	0	11	1	12	1
38	0	10	0	12	1
35	0	18	1	19	1
26	0	9	0	10	0
64	1	8	0	11	1
55	1	15	1	16	1
28	0	13	1	16	1
34	0	9	0	12	1
65	1	7	0	9	0
55	1	10	0	12	1
34	0	14	1	15	1
33	0	9	0	12	1
34	0	12	1	14	1
21	0	10	0	12	1
30	0	10	0	11	1
33	0	12	1	15	1
27	0	13	1	14	1
33	0	9	0	10	0
32	0	10	0	12	1
27	0	10	0	11	1

33	0	10	0	12	1
28	0	10	0	14	1
29	0	13	1	14	1
27	0	10	0	11	1
29	0	10	0	12	1
35	0	9	0	10	0
26	0	9	0	10	0
26	0	9	0	10	0
29	0	10	0	11	1
34	0	10	0	12	1
27	0	11	1	13	1
34	0	13	1	14	1
32	0	12	1	15	1
29	0	9	0	10	0
30	0	9	0	10	0
25	0	12	1	15	1
28	0	10	0	12	1
54	1	7	0	9	0
26	0	12	1	13	1
38	0	5	0	7	0
36	0	10	0	12	1
41	1	12	1	14	1
34	0	12	1	15	1
65	1	9	0	11	1
44	1	6	0	8	0
50	1	12	1	14	1
32	0	12	1	13	1
29	0	11	1	13	1
28	0	13	1	15	1
38	0	7	0	9	0
39	1	7	0	10	0
34	0	14	1	16	1
37	0	10	0	12	1
30	0	9	0	11	1
50	1	7	0	8	0
43	1	11	1	12	1
29	0	12	1	13	1
32	0	10	0	11	1
28	0	13	1	16	1
24	0	10	0	11	1
28	0	14	1	17	1
33	0	7	0	8	0
36	0	12	1	14	1
26	0	9	0	10	0
33	0	13	1	15	1
31	0	10	0	11	1
31	0	11	1	12	1
35	0	11	1	12	1
32	0	14	1	15	1
26	0	9	0	10	0

27	0	13	1	15	1
27	0	12	1	13	1
36	0	12	1	15	1
29	0	9	0	12	1
30	0	12	1	14	1
23	0	9	0	10	0
36	0	10	0	12	1
31	0	13	1	14	1
36	0	10	0	12	1
33	0	14	1	17	1
37	0	10	0	12	1
28	0	12	1	15	1
34	0	11	1	14	1
17	0	12	1	14	1
44	1	6	0	7	0
25	0	7	0	11	1
25	0	13	1	14	1
27	0	10	0	11	1
28	0	8	0	12	1
27	0	10	0	13	1
27	0	10	0	13	1
27	0	11	1	15	1
32	0	13	1	14	1
29	0	10	0	14	1
27	0	9	0	10	0
25	0	13	1	14	1
26	0	10	0	12	1
26	0	7	0	8	0
45	1	7	0	9	0
24	0	12	1	14	1
25	0	13	1	14	1
35	0	12	1	15	1
30	0	11	1	14	1
35	0	12	1	15	1
34	0	10	0	12	1
20	0	12	1	13	1
31	0	12	1	13	1
40	1	10	0	20	1
25	0	12	1	14	1
50	1	11	1	13	1
43	1	9	0	11	1
46	1	9	0	13	1
20	0	12	1	11	1
23	0	9	0	10	0
29	0	10	0	11	1
41	1	7	0	8	0
39	1	9	0	10	0
28	0	14	1	16	1
37	0	10	0	12	1
23	0	9	0	10	0

35	0	7	0	8	0
35	0	14	1	17	1
30	0	8	0	9	0
17	0	12	1	13	1
23	0	9	0	10	0
40	1	10	0	12	1
41	1	10	0	11	1
43	1	9	0	11	1
33	0	10	0	12	1
20	0	12	1	14	1
23	0	9	0	10	0
29	0	10	0	11	1
40	1	13	1	15	1
41	1	7	0	8	0
39	1	9	0	10	0
28	0	14	1	16	1
26	0	13	1	15	1
32	0	17	1	21	1
29	0	12	1	14	1
29	0	14	1	16	1
26	0	9	0	10	0
23	0	11	1	13	1
23	0	11	1	12	1
24	0	12	1	13	1
30	0	13	1	15	1
34	0	13	1	14	1
30	0	10	0	12	1
28	0	8	0	12	1
39	1	12	1	18	1
33	0	10	0	11	1
18	0	12	1	16	1
28	0	14	1	16	1
28	0	13	1	15	1
25	0	12	1	13	1
23	0	13	1	16	1
65	1	7	0	9	0
57	1	13	1	14	1
25	0	13	1	14	1
22	0	9	0	12	1
42	1	13	1	15	1
25	0	14	1	15	1
28	0	13	1	15	1
23	0	13	1	15	1
27	0	9	0	10	0
36	0	9	0	12	1
34	0	7	0	12	1
25	0	12	1	15	1
35	0	10	0	11	1
31	0	13	1	15	1
45	1	10	0	11	1

10	0	11	1	10	0

LV FUNCTION _EF(%)	LV FUNCTION _EF(%) GRO	FS(%)	FS(%) GR	EDV	ESV	MV
45	1	23	1			N
50	1	25	1	99	45	N
46	1	23	1	86	43	N
45	1	23	1	130	70	N
40	1	20	1	109	64	N
36	1	18	1			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
30	1	15	1	163	123	N
38	1	19	1	128	82	N
35	1	18	1	137	81	MR
34	1	17	1	191	128	N
60	0	30	0			N
60	0	30	0			N
34	1	17	1	150	109	N
60	0	30	0			N
46	1	23	1			N
36	1	18	1	164	104	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
42	1	21	1	82	44	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
28	1	14	1	127	94	N
60	0	30	0			N
60	0	30	0			N
62	0	31	0			N
60	0	30	0			N
42	1	21	1	78	45	N
60	0	30	0			N
60	0	30	0			N
48	1	24	1			N
48	1	24	1			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
48	1	24	1			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
45	1	22	1	70	38	N
22	1	10	1			N
60	0	30	0			N

60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
30	1	109	0	50		MVP
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
33	1	17	1	141	95	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
35	1	18	1			N
36	1	18	1	62	36	N
60	0	30	0			N
35	1	18	1			N
60	0	30	0			N
60	0	30	0			N
38	1	19	1	192	117	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0	109	50	N
60	0	30	0			N
60	0	30	0			N
50	1	25	1	124	54	N
30	1	15	1	180	130	N
60	0	30	0			N
60	0	30	0			N
28	1	14	1	223	166	N
35	1	18	1	172	111	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0	109	32	N
60	0		1			N
60	0	30	0			N
60	0	30	0			N
30	1	15	1			N
60	0	30	0			N
60	0	30	0			N
47	1	24	1	156	89	N

60	0	30	0			N
46	1	23	1	114	62	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
32	1	16	1			N
32	1	16	1	161	108	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
36	1	18	1	130	80	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0	109	32	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
30	1	15	1			N
60	0	30	0			N
60	0	30	0			N
47	1	24	1	156	89	N
60	0	30	0			N
60	0	30	0			N
30	1	15	1			N
60	0	30	0			N
24	1	12	1	278	200	N
28	1	14	1			N
60	0	30	0			N
60	0	30	0			N
22	1	11	1			N
38	1	19	1			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N

60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
46	1	23	1	91	50	N
60	0	30	0			N
60	0	30	0			N
30	1	15	1	151	126	N
60	0	30	0			N
44	1	22	1	91	51	N
37	1	18	1	110	68	N
48	1	24	1	125	68	N
60	0	30	0			N
20	1	10	1	205	180	N
47	1	24	1			N
30	1	15	1	189	142	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
46	1	23	1	170	89	N
38	1	19	1			N
20	1	24	1			N
32	1	16	1			N
60	0	30	0			N
32	1	16	1			N
36	1	18	1	173	110	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
44	1	22	1	103	63	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N

60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
58	0	29	0			N
60	0	30	0			N
55	0	28	0			N
60	0	30	0			N
60	0	30	0			N
36	1	18	1	118	65	N
60	0	30	0			N
42	1	21	1	129	72	N
42	1	21	1	89	50	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
30	1	15	1	89	62	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
42	1	21	1			N
60	0	30	0			N
60	0	30	0			N
44	1	22	1	108	68	N
60	0	30	0	58	59	N
33	1	17	1	113	83	N
37	1	18	1	83	52	N
35	1	18	1	131	85	N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
42	1	21	1	89	51	N
32	1	16	1			N
55	0	28	0			N
60	0	30	0			N
60	0	30	0			N

45	1	23	1	76	43	N
60	0	30	0			N
37	1	19	1	96	62	N
60	0	30	0			N
60	0	30	0			N
42	1	21	1	138	70	N
25	1	13	1			N
37	1	18	1	83	52	N
36	1	18	1			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
42	1	21	1			N
42	1	21	1	89	51	N
32	1		1			N
55	0	28	0			N
52	1	26	1	97	47	N
60	0	30	0			N
60	0	30	0			N
36	1	18	1			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
46	1	23	1			N
60	0	30	0			N
62	0	32	0			N
52	1	25	1			N
60	0	30	0			N
60	0	30	0			N
60	0	30	0			N
22	1	11	1			N
28	1	14	1	158	128	N
60	0	30	0			N
60	0	30	0			N
32	1	16	1	137	85	N
60	0	30	0			N
58	0	29	0			N
60	0	30	0			N
52	1	26	1	81	40	N
50	1	25	1			N
32	1	16	1			N
60	0	30	0			N
60	0	28	0			N
60	0	30	0			N
38	1	20	1	145	84	N

60	0	30	0			N

AV	TV	PV	PERICARDIUM	WMA	CC	LVH	LA-D
N	N	N	N	GHK	**CC**		
N	N	N	N	RWMA	LVH(CONC)	Y	
N	N	N	N	RWMA	N		
N	N	N	N	RWMA	N		
N	N	N	N	RWMA	RA/RV/LV-D		
N	N	N	N	RWMA	LVH(CONC)	Y	
N	N	N	N	NO	N		
N	N	N	N	NO	N		
N	N	N	N	NO	RA/RV-D		
N	N	N	N	NO	LVH(CONC)	Y	
N	N	N	N	NO	N		
N	N	N	N	NO	LVH(CONC)	Y	
N	N	N	N	RWMA	LV-D		
N	N	N	N	RWMA	LV-D		
N	N	N	N	RWMA	LV-D		
N	N	N	N	RWMA	LA/LV-D		Y
N	N	N	N	NO	CR		
N	N	N	9	NO	LVH	Y	
N	N	N	N	RWMA			
N	N	N	N	NO	LVH	Y	
N	N	N	N	RWMA	N		
N	N	N	N	RWMA	LV-D		
N	N	N	N	NO	N		
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	LVH	Y	
N	N	N	N	RWMA	LA-D		Y
N	N	N	N	NO	N		
N	N	N	N	NO	N		
N	N	N	N	NO	LVH	Y	
N	N	N	N	RWMA	LV-D		
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	N		
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	N		
N	N	N	N	RWMA			
N	N	N	N	NO	N		
N	N	N	N	NO	LVH	Y	
N	N	N	N	RWMA	N		
N	N	N	N	RWMA	N		
N	N	N	N	NO	N		
N	N	N	N	NO	N		
N	N	N	N	NO	N		
N	N	N	N	RWMA	N		
N	N	N	N	NO	N		
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	N		
N	N	N	N	RWMA	LV-D		
N	N	N	N	GHK	LVH,LA-D	Y	Y
N	N	N	N	NO	N		

N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	LVH,LA-D	Y	Y
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	N		
N	N	N	N	NO	N		
N	N	N	N	NO	CR		
N	N	N	N	NO	LVH,LA-D	Y	Y
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	LVH	Y	
N	N	N	N	RWMA	LA/LV-D		Y
N	N	N	N	NO	LVH	Y	
N	N	N	N	NO	LVH,LA-D	Y	Y
N	N	N	N	NO	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	GHK	N		
N	N	N	N	RWMA	LVH,LV-D	Y	
N	N	N	N	NO	N		
N	N	N	PE	GHK	LV-D		
N	N	N	N	NO	N		
N	N	N	N	NO	LVH	Y	
N	N	N	N	RWMA	LA-D		Y
N	N	N	N	NO	LVH	Y	
N	N	N	N	N	LVH,LA/RA-D	Y	Y
N	N	N	N	NO	N		
N	N	N	N	NO	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	RWMA	LA-D		Y
N	N	N	N	RWMA			
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	RWMA			
N	N	N	N	RWMA	LVH,LA-D	Y	Y
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	LA-D		Y
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	GHK OF LV	LA/LV-D		Y
N	N	N	N	N	N		
N	N	N	N	N	LA-D		Y
N	N	N	N	RWMA	LVH	Y	

N	N	N	N	N	N		
N	N	N	N	RWMA	N		
N	N	N	N	N	LA-D		Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LV-D		
N	N	N	N	RWMA	LA/LV-D		Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	RWMA	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	LA-D		Y
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	GHK	LA/LV-D		Y
N	N	N	N	N	N		
N	N	N	N	N	LA-D		Y
N	N	N	N	RWMA	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	RWMA	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	GHK	LV-D		
N	N	N	N	GHK	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	GHK	LV-D		
N	N	N	N	RWMA	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	CR		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	LVH,LA-D	Y	Y

N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	CR		
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	RWMA	N		
N	N	N	N	RWMA	LVH	Y	
N	N	N	N	RWMA	N		
N	N	N	N	RWMA			
N	N	N	N	N	LVH	Y	
N	N	N	N	RWMA	N		
N	N	N	N	RWMA	LA/LV-D		Y
N	N	N	N	GHK	LVH,LV-D	Y	
N	N	N	N	NO	LVH	Y	
N	N	N	N	RWMA	LV-D		
N	N	N	N	RWMA			
N	N	N	N	RWMA			
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH-LA-D	Y	Y
N	N	N	N	RWMA	N		
N	N	N	N	RWMA			
N	N	N	N	RWMA			
N	N	N	N	RWMA			
N	N	N	N	N	N		
N	N	N	N	RWMA			
N	N	N	N	RWMA			
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	RWMA	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LA-D		Y

N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	N		
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LA-D		Y
N	N	N	N	N	LVH	Y	
N	N	N	N	RWMA	LA/LV-D		Y
N	N	N	N	RWMA	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	N	CR,RWT=0.47		
N	N	N	N	N	N		
N	N	N	N	N	CR		
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	GHK	LV-D		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	RWMA	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	RWMA	LA-D		Y
N	N	N	N	N	LVH	Y	
N	N	N	N	RWMA	LV-D		
N	N	N	N	RWMA	LV-D		
N	N	N	N	RWMA	LA/LV-D		Y
N	N	N	N	N			
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	RWMA	LV-D		
N	N	N	N	GHK	N		
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	N		
N	N	N	N	N	N		

N	N	N	N	RWMA	LV-D		
N	N	N	N	N	LVH	Y	
N	N	N	N	RWMA	LA-D		Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LA-D		Y
N	N	N	N	GHK	N		
N	N	N	N	RWMA	N		
N	N	N	N	RWMA	LA-D		Y
N	N	N	N	RWMA			
N	N	N	N	N	CR		
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	RWMA			
N	N	N	N	RWMA	LV-D		
N	N	N	N	GHK	N		
N	N	N	N	N	LVH,LV-D	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH,LA/RA-D	Y	Y
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	RWMA	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	CR		
N	N	N	N	N	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	N	N		
N	N	N	N	RWMA	LVH	Y	
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH,LA-D	Y	Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	RWMA	N		
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	GHK	LVH,LA/LV-D	Y	Y
N	N	N	N	N	LA-D		Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		
N	N	N	N	RWMA	LA-D		Y
N	N	N	N	GHK	LA-D		Y
N	N	N	N	RWMA			
N	N	N	N	N	LA-D		Y
N	N	N	N	N	LVH	Y	
N	N	N	N	N	N		

N	N	N	N	N	N		

LV-D	RA/RV-D	VELOCITY (GRADIENT)_MV-E	VELOCITY (GRADIENT)_MV-A
		67	108
		67	108
		58	47
		87	42
Y	Y		
		74	47
		56	58
	Y		
		82	55
		67	52
		57	70
Y		47	92
Y		147	
Y			
Y			
		62	80
		82	109
		89	83
		87	81
Y		64	97
		52	66
		52	69
		72	49
		88	79
		66	99
		66	79
Y			
		53	71
		110	
		102	115
		51	54
		50	88
		55	82
		44	59
		119	84
		62	79
		105	60
		77	60
		82	68
Y		68	53
		61	53
		59	55

		88	101
		78	47
		110	98
		80	75
		90	84
		63	93
		91	
		53	71
		114	97
		64	59
Y		148	
		69	83
		60	74
		66	113
		141	
Y			
		57	102
Y		53	65
		89	73
		106	99
		85	70
		52	44
		92	74
		77	78
		47	67
		63	74
		66	88
		61	57
		53	98
		71	80
Y		76	63
		76	96
		126	105

		77	93
		46	53
		77	75
		96	104
Y			
Y			
		57	72
		68	82
		85	66
		81	84
		81	103
		61	57
		53	98
		71	80
Y		76	63
		76	96
		126	105
		110	
		67	54
		59	50
Y			
		113	46
		47	71
		41	70
Y			
		80	65
		62	85
		66	65
		60	101
		76	89
		46	89
		79	69
		94	88
		108	66

		59	55
		123	127
		133	80
		53	77
		72	89
		63	73
		97	77
		64	84
		82	76
		113	101
		78	69
		80	97
		65	93
Y			
Y		60	81
		62	79
Y		99	53
		85	112
		81	110
		99	113
		118	141
		62	79
		61	60
		71	89
		83	80
		59	69
		80	68
		59	104
		57	81
		75	97
		80	79
		87	85
		78	

		61	81
		58	83
		85	74
		64	104
		75	83
		144	114
		75	83
		83	142
		110	
		64	86
		143	143
		83	130
Y			
		65	109
		115	82
		44	59
		86	124
		48	99
		81	102
		84	96
		79	93
		68	64
		40	45
Y			
		90	77
		79	93
		91	114
		80	80
		56	92
		101	110
		85	109
		95	103
		58	59
Y			
Y			
Y			
Y		131	115
		94	
		108	92
		110	

Y			
		96	104
		123	65
		83	90
		101	
Y		131	115
		94	
Y		108	92
		71	119
		73	65
		88	68
		59	80
		104	78
		61	74
		97	71
		115	82
		89	98
		85	83
		66	86
		70	98
		81	88
		62	76
Y		102	
		73	95
		96	87
		117	57
		137	

		123	

VELOCITY (GRADIENT)_AV	VELOCITY (GRADIENT)_TV	VELOCITY (GRADIENT)_PV
74		
102		
115		
186		
100		
128		
111		
107		
91		
139		
64		
95		
117		
114		
109		

105		
114		
99		
106		
107		
124		
92		
120		
137		
133		
113		
109		
102		
136		

93		
97		
80		
176		
128		
108		
102		
136		
106		
91		
76		
80		
133		
141		
113		

109		
147		
81		
94		
67		
133		
121		
125		
128		
107		
133		
110		
102		
115		
96		
134		
85		
115		

118		
111		
86		
113		
91		
115		
95		
144		
115		
100		
88		
132		
146		
146		
156		
133		
120		
91		

94		
99		
120		
167		
136		
93		
107		
89		
109		
118		
140		
119		
133		

GRADE_MR	GRADE_AR	GRADE_TR	GRADE_PR	SD	DD	LVSD GROUP
NIL	MILD	NIL	NIL	NO	I	NO
NIL	MILD	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
MILD	NIL	NIL	NIL	MILD	NO	YES
MILD	NIL	MILD	NIL	MILD	NO	YES
MILD	NIL	MILD	NIL	MOD	III	YES
NIL	NIL	TR	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
MILD	NIL	MILD	NIL	SEVERE	I	YES
NIL	NIL	NIL	NIL	MOD	NO	YES
MR	NIL	NIL	NIL	MOD	NO	YES
MR(MOD)	MILD	MILD	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	MILD	NIL	MOD	NO	YES
NIL	MILD	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	TRIVIAL	MILD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
TRIVIAL	NIL	NIL	NIL	SEVERE	NO	YES
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	AS	MILD	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	MILD	NIL	MILD	II	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	MILD	NIL	SEVERE	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO

NIL	MILD	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
TRIVIAL	TRIVIAL	TRIVIAL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	II	NO
NIL	NIL	TRIVIAL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	MILD	NIL	MOD	III	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	TRIVIAL	TRIVIAL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MOD	NO	YES
MILD	MILD	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	MILD	NIL	NO	NO	NO
NIL	NIL	TRIVIAL	NIL	NO	NO	NO
TRIVIAL	TRIVIAL	TRIVIAL	NIL	NO	NO	NO
NIL	NIL	MILD	NIL	NO	II	NO
MILD	MILD	MILD	NIL	NO	II	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	SEVERE	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MOD	NIL	NIL	NIL	SEVERE	III	YES
NIL	MILD	MILD	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MOD.	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	TRIVIAL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	SEVERE	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	MILD	II	YES

NIL	NIL	MILD	NIL	NO	NO	NO
NIL	MILD	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	TRIVIAL	NIL	NO	NO	NO
MILD	MILD	MILD	NIL	MOD	III	YES
MOD.	NIL	NIL	NIL	MOD	III	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	SEVERE	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	MILD	II	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	SEVERE	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	SEVERE	NO	YES
NIL	TRIVIAL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	SEVERE	NO	YES
NIL	NIL	NIL	NIL	SEVERE	II	YES
NIL	MILD	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	TRIVIAL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	MILD	MILD	NIL	NO	I	NO
NIL	NIL	MILD	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	N	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO

NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	MILD	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MOD	N	NIL	NIL	SEVERE	III	YES
NIL	NIL	MILD	NIL	NO	II	NO
NIL	NIL	NIL	NIL	MILD	I	YES
NIL	NIL	NIL	NIL	MOD	II	YES
MILD	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	MILD	MILD	SEVERE	II	YES
MOD	NIL	NIL	NIL	MOD	II	YES
MOD	NIL	NIL	NIL	SEVERE	III	YES
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	TRIVIAL	NIL	NO	I	NO
NIL	TRIVIAL	MILD	NIL	NO	II	NO
NIL	TRIVIAL	NIL	NIL	MILD	NO	YES
MILD	NIL	NIL	NIL	SEVERE	NO	YES
MILD	NIL	NIL	NIL	NO	II	NO
MILD	NIL	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	MOD	NO	YES
MILD	NIL	NIL	NIL	MOD	I	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	MILD	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	MILD	MILD	NIL	NO	I	NO

NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	TRIVIAL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	MILD	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	IV	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	MILD	MILD	MILD	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
MILD	NMILD	MOD	NIL	MOD	NO	YES
NIL	NIL	TRIVIAL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	MILD	NO	YES
MILD	TRIVIAL	TRIVIAL	NIL	MILD	NO	YES
				NO	I	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	N	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	MILD	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NMILD	NIL	NO	NO	NO
MILD	MILD	MILD	MILD	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	MILD	NIL	NO	II	NO
MILD	MILD	MILD	NIL	NO	I	NO
MILD	NIL	MILD	NIL	MILD	II	YES
NIL	NIL	MILD	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	MOD	NO	YES
NIL	MILD	MILD	NIL	MOD	II	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	TRIVIAL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	MILD	NIL	MILD	II	YES
MILD	NIL	MILD	NIL	SEVERE	NO	YES
MILD	MILD	NIL	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO

NIL	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	TRIVIAL	NIL	NO	NO	NO
MOD	NIL	MILD	NIL	MOD	III	YES
NIL	MILD	MILD	NIL	NO	NO	NO
MOD	NIL	MOD	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	MILD	NO	YES
MOD	TRIVIAL	NIL	NIL	SEVERE	NO	YES
NIL	NIL	NIL	NIL	MOD	NO	YES
MILD	NIL	NIL	NIL	MOD	NO	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MOD	NIL	NIL	NIL	MOD	NO	YES
MILD	NIL	MILD	NIL	MILD	II	YES
MILD	NIL	MILD	NIL	SEVERE	NO	YES
MILD	MILD	NIL	NIL	NO	II	NO
NIL	MILD	MILD	MILD	NO	II	NO
NIL	NIL	MILD	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	II	NO
MILD	MILD	NIL	NIL	MOD	II	YES
NIL	NIL	MILD	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	MILD	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	MILD	NO	YES
NIL	NIL	NIL	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	III	NO
MILD	NIL	MILD	NIL	NO	II	NO
NIL	MILD	MILD	NIL	NO	II	NO
MILD	MILD	NIL	NIL	NO	I	NO
MILD	NIL	NIL	NIL	SEVERE	NO	YES
MOD	NIL	NIL	NIL	SEVERE	NO	YES
MILD	NIL	NIL	NIL	NO	II	NO
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	MILD	MILD	NIL	MOD	III	YES
NIL	NIL	MILD	NIL	NO	IV	NO
NIL	MILD	NIL	NIL	NO	I	NO
NIL	NIL	NIL	NIL	NO	I	NO
NIL	MOD.	NIL	NIL	NO	NO	NO
MILD	NIL	MILD	NIL	NO	II	NO
SEV	NIL	MOD	NIL	SEVERE	III	YES
NIL	NIL	NIL	NIL	MOD	I	YES
NIL	NIL	NIL	NIL	NO	NO	NO
NIL	NIL	NIL	NIL	NO	NO	NO
MILD	NIL	NIL	NIL	SEVERE	NO	YES

NIL	NIL	MILD	NIL	NO	NO	NO

LVDD GROUP	OVERALL
YES	1
YES	1
NO	1
NO	1
NO	1
YES	1
NO	
NO	
NO	
NO	
NO	
YES	1
YES	1
NO	1
NO	1
NO	1
NO	
NO	
NO	1
NO	
NO	1
NO	1
NO	
YES	1
YES	1
NO	1
NO	
NO	
NO	
NO	1
YES	1
NO	
YES	1
NO	
YES	1
NO	
YES	1
NO	1
NO	1
NO	
NO	
NO	
NO	1
NO	
NO	
NO	
NO	1
NO	1
NO	

NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	
YES	1
NO	
YES	1
NO	
NO	
YES	1
NO	
NO	
NO	
NO	
NO	
NO	1
NO	1
NO	
NO	1
NO	
YES	1
NO	1
NO	
NO	
NO	
NO	
YES	1
YES	1
NO	1
NO	1
NO	
NO	
YES	1
NO	1
NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	1
NO	
YES	1
YES	1

NO	
NO	1
NO	
NO	
NO	
NO	
NO	
NO	
YES	1
YES	1
NO	
NO	
NO	
NO	
YES	1
NO	
NO	
NO	
NO	1
NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	1
NO	
YES	1
YES	1
NO	
NO	
NO	1
NO	
NO	1
NO	1
NO	
NO	
NO	1
YES	1
NO	
NO	
NO	
NO	
NO	
YES	1
NO	
NO	
NO	
NO	

NO	
NO	
YES	1
YES	1
NO	
NO	
NO	
NO	
NO	
NO	
NO	
YES	1
NO	
NO	
NO	1
NO	
NO	
YES	1
YES	1
YES	1
YES	1
NO	1
NO	
YES	1
YES	1
YES	1
YES	1
YES	1
YES	1
NO	1
NO	1
YES	1
NO	1
NO	
NO	1
YES	1
NO	
NO	
NO	
NO	
NO	
NO	1
YES	1
NO	
YES	1
NO	
NO	
NO	
NO	
YES	1

YES	1
YES	1
YES	1
NO	
YES	1
NO	
NO	
YES	1
NO	
NO	
NO	
YES	1
NO	1
NO	
NO	1
NO	1
YES	1
NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	
NO	
YES	1
YES	1
NO	
NO	1
YES	1
YES	1
YES	1
NO	
NO	1
NO	1
YES	1
NO	
NO	
NO	
YES	1
NO	1
YES	1
NO	
NO	

NO	1
NO	
YES	1
NO	
NO	
NO	1
NO	1
NO	1
NO	1
NO	
NO	
NO	
NO	1
YES	1
NO	1
YES	1
YES	1
YES	1
YES	1
YES	1
NO	
YES	1
NO	
YES	1
YES	1
NO	
NO	
NO	
NO	1
YES	1
YES	1
YES	1
YES	1
YES	1
YES	1
NO	1
NO	1
YES	1
NO	
YES	1
YES	1
YES	1
YES	1
NO	
YES	1
YES	1
YES	1
NO	
NO	
NO	1

NO	

Baba Farid University
of Health Sciences
Sadiq Road
Faridkot-151 203 (Pb) INDIA
Phone 01639-256232-256236
Tele/Fax 01639-256235
Email - Examinationcell@bfuhs.ac.in

14

No. BFUHS/2K19p/DMC/5125

Date 29/5/19

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.05.2019 has approved the plan of thesis of **Kapil Dev**, a student of your college for **MD General Medicine** along with the names of Supervisor/Co-Supervisor as under :-

Topic Plan of Thesis

Echocardiographic assessment and correlates among long standing type 2 diabetics

Supervisor
Dr. Dinesh Gupta
Prof. & Head,
Dept. of Medicine,
DMCH, Ludhiana

Co-Supervisor
Dr. Parminder Singh
Prof. & Head,
Dept. of Endocrinology,
DMCH, Ludhiana.

Dr. Gurpreet Singh
Wander
Prof. & Head,
Dept. of Cardiology,
DMCH, Ludhiana.

The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic(if any).

S P Singh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
2. *The student may submit the thesis as per the schedule already conveyed i.e. for May/June examination 30th Nov. of the preceding the year of examination and for Nov/Dec. examinations 31st May of the year of examination.*

ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF MEDICINE

IN

MEDICINE

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

NOVEMBER, 2018

DR. KAPIL DEV

DEPARTMENT OF MEDICINE
DAYANAND MEDICAL COLLEGE & HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS
For the degree of	MD MEDICINE
Name of the candidate	Dr. Kapil Dev
Supervisor	Dr. Dinesh Gupta, Professor & Head, Department of Medicine, DMCH, Ludhiana
Co-supervisor	Dr. Parminder Singh Professor & Head, Department of Endocrinology, DMCH, Ludhiana Dr. Gurpreet Singh Wander, Professor & Head, Department of Cardiology, DMCH, Ludhiana.
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Worldwide, there are approximately 422 million adult cases of type 2 diabetes and this number is expected to double by 2030. There are approximately 72million diabetics in India presently and this number is expected to cross 100million in 2030.

Aim of Study: The purpose of the study to find out prevalence and correlation of left ventricular systolic & diastolic dysfunction in diabetic patients.

Materials & methods: A total of 300 patients with diabetes of more than 7 years duration will be studied. Echocardiography will be performed to assess left ventricular functions.

Clinical Significance: Diabetes mellitus increases the risk of heart failure independent of coronary heart disease and hypertension, may cause asymptomatic heart failure in diabetics. However, the frequency with which this occurs is not well defined .echocardiographic parameters in asymptomatic diabetics patients will assess the burden of Left ventricular (LV) dysfunctions, active intervention can be done to prevent heart failure and will decrease economic burden due to heart failure in diabetic patients.

Keywords: Diabetes mellitus, diastolic dysfunction, echocardiography, E/a ratio, LA size.

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis entitled "**ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS**" exist in the Department of Medicine, Dayanand Medical College & Hospital, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate himself under our supervision and guidance.

Supervisor

Dr. Dinesh Gupta
Professor & Head
Department of Medicine
DMCH, Ludhiana

Co-Supervisor

Dr. Parminder Singh
Professor & Head
Department of Endocrinology
DMCH, Ludhiana

Dr. Gurpreet S Wander
Professor & Head
Department of Cardiology
DMCH, Ludhiana

Head of Department

Dr. Dinesh Gupta
Professor & Head
Department of Medicine
DMCH, Ludhiana

Place : LUDHIANA

Date : 17/10/2018

APPROVAL PROFORMA
BY RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	DR. KAPIL DEV
Department	MEDICINE
Topic of Thesis	ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS
Likely date of appearing in PG examination	JUNE 2021
Date of enrollment	10th MAY 2018
Name of Head of Department	DR. DINESH GUPTA
1) Supervisor	DR. DINESH GUPTA
2) Co-Supervisor	DR. PARMINDER SINGH DR. GURPREET SINGH WANDER
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
1. HOD Pharmacology	1. HOD Physiology
2. HOD Surgery	2. HOD Pathology
3. HOD Pathology	3. HOD Pharmacology
4. HOD Medicine	4. HOD SPM
5. Dean Academics	5. HOD Medicine
6. Vice Principal	6. HOD Surgery
	7. HOD Obst. & Gynae.
	8. Legal Expert
	9. Secretary, IEC
	10. Dean Academics
	11. Vice Principal
	12. Principal

Approved: Yes / No

Chairperson
Research Committee

Chairperson
Research Committee

Approved: Yes / ~~No~~

Chairperson
Ethics Committee

Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	**NAME OF THE CANDIDATE AND ADDRESS**	DR. KAPIL DEV, H.NO.98 W.NO.14 BRAHMAN MAJRA, SIRHIND, DISTRICT FATEHGARH SAHIB, PUNJAB
2	**NAME OF THE INSTITUTE**	DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA
3	**COURSE OF STUDY AND SUBJECT**	MD MEDICINE
4	**DATE OF ADMISSION OF COURSE**	10 MAY 2018
5	**TITLE OF THE TOPIC**	ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Diabetes and cardiovascular diseases are rapidly gaining pandemic proportions in the south east Asian subcontinent, and India is the leading the race of numbers. Diabetes mellitus is one of the most common diseases in the world and is acquiring epidemic proportions; its prevalence is growing in both developed and developing countries. Indians are genetically more prone to diabetes compared to other races. Cardiovascular complications are known to be the main cause of morbidity and mortality in diabetic Patients. There is increased risk of ischemic heart disease and cardiomyopathy which may lead to heart failure (diastolic heart failure). Left ventricular diastolic dysfunction represents an early stage of heart failure, without any clinical manifestations, in view of these above facts, this study will be done to asses the diastolic dysfunction in diabetic Patients. One of the important factors contributing to increased prevalence of type 2 diabetics in Asian Indians is the fact that they have a greater degree of insulin resistance compared to Caucasians [2-4], Mohan et al first demonstrated that Asians have higher insulin levels to a glucose load than Europeans.[4]

The Framingham study pointed out a previously unknown factor in diabetic patients that causes much higher incidence of cardiovascular complications.[5] Diabetic individuals have higher serum concentrations of lipids and hypertension, obesity and thus the pathogenesis of advanced atherosclerosis. Type2 diabetics are also prone to silent myocardial ischemia before the development of overt coronary artery disease.[6] This is a reflection of

accelerated coronary atherosclerosis, though the autonomic neuropathy has also been implicated in its causation.[7]

Several mechanisms for diabetic cardiomyopathy have been proposed including small and microvascular disease, autonomic dysfunction, metabolic derangements, interstitial fibrosis and the development of fibrosis, possibly caused by the accumulation periodic acid-Schiff-positive glycoprotein, leading to myocardial hypertrophy and diastolic dysfunction.[8-11]

Diastolic dysfunction has been Describe as an early sign of this diabetic Heart muscle disease preceding the systolic damage. The pathogenesis of this ventricular dysfunction remains unknown and has been somewhat controversial. Hence the present study was planned at tertiary care Centre to detect the left diastolic dysfunction in type 2 diabetes individuals and to use echo-cardiologic assessment as an early detector of the left diastolic dysfunction.[12]

6.2 REVIEW OF LITERATURE

The incidence of diabetes mellitus (DM) is increasing worldwide and rapidly assuming epidemic proportions. Over the last three decades, a number of epidemiological, clinical and autopsy studies have proposed the presence of diabetic heart disease as a distinct clinical entity. Diastolic heart failure (HF) is also referred to as HF, with preserved left ventricular systolic function. Many studies have reported that the incidence of heart failure in diabetic subjects is high even in the absence of hypertension and coronary artery disease. Studies have reported a high prevalence of pre-clinical diastolic dysfunction among subjects with DM.[13] The evidence indicates that myocardial damage in diabetic subjects affects diastolic function before the systolic function. The pathogenesis of this left ventricular (LV) dysfunction in diabetic subjects is not clearly understood.

Diabetic cardiomyopathy has been proposed as an independent cardiovascular disease, and many mechanisms, such as microvascular disease, autonomic dysfunction, metabolic disorders, and interstitial fibrosis, have been suggested as causative factors.[14] However, the exact etio-pathogenesis of diabetic cardiomyopathy still remains unclear. So far, very few population-based studies have been carried out in India, to demonstrate the prevalence of diastolic dysfunction in diabetic subjects in the Indian patients. The objective of our study is to determine whether there is any association between diastolic dysfunction and type 2DM, even in the asymptomatic subjects.[15] Thus, observational cross sectional study will conducted with the aim of determining the prevalence of asymptomatic and symptomatic Left ventricular (LV) diastolic dysfunction in type 2 diabetes

subjects, and its relation to age, duration of DM, HbA1c, obesity indices and other diabetic complications such as microangiopathies.[15]

Preclinical Diastolic Dysfunction (PDD) - broadly defined as subjects with left ventricular diastolic dysfunction, without the diagnosis of congestive heart failure (HF), and with normal systolic function. PDD is an entity which remains poorly understood, yet has definite clinical significance. Although few original studies have focused on PDD, it has been shown that PDD is prevalent, and that there is a clear progression from PDD to symptomatic heart failure including dyspnea, edema, and fatigue. In diabetic patients and patients with coronary artery disease or hypertension, it has been shown that patients with PDD have a significantly higher risk of progression to heart failure and death compared to patients without PDD. Because of these findings and the increasing prevalence of the heart failure epidemic, it is clear that an understanding of PDD is essential to decreasing patients' morbidity and mortality. This review will focus on what is known concerning preclinical diastolic dysfunction, including definitions, staging, epidemiology, pathophysiology, and the natural history of the disease. In addition, given the paucity of trials focused on PDD treatment, studies targeting risk factors associated with the development of PDD and therapeutic trials for heart failure with preserved ejection fraction will be reviewed.[16]

Left ventricular diastolic dysfunction (LVDD) represents the first stage of diabetic cardiomyopathy preceding changes in systolic function, reinforcing the importance of early examination of ventricular function in individuals with diabetes mellitus (DM). This cross-sectional study will be conducted to determine the incidence of LVDD in newly diagnosed cases of type 2

diabetes subjects, and its relation to glycosylated hemoglobin (HbA1C), age at the time of diagnosis, body mass index and serum total cholesterol.[17]

MIKAEL KJAER POULSEN et. al STUDY concluded that the prevalence of Left ventricular (LV) diastolic dysfunction in 305 patients was high in patients with T2DM with no history of cardiovascular disease. The study suggested a close association between the presence of advanced Left ventricular (LV) diastolic dysfunction and abnormal myocardial perfusion. Thus, findings support that moderate or severe Left ventricular (LV) diastolic dysfunction and Left atrium (LA) dilation in the early phase of T2DM is closely associated with intrinsic LV dysfunction.[18]

Study conducted by patil MB et al concluded that diastolic dysfunction was present in 32 (64%) of the patients. Diastolic dysfunction was more common among female sex (68.18%) compared to male (60.17%). Diastolic dysfunction was significantly associated with uncontrolled diabetes as assessed by HbA1c levels. Diastolic dysfunction was more common in patients who were on treatment with both oral hypo glycemic agents and insulin. The prevalence of diastolic dysfunction increased with longer duration of diabetes. There was a linear progression of diastolic dysfunction with the increase age group.[19]

The findings in his study indicate that myocardial damage in patients with diabetes affects diastolic dysfunction before systolic function. E/A ratio and Left atrial size are significantly altered in diabetic patients with diastolic dysfunction. Diastolic dysfunction is significantly associated with duration of disease, glycemic levels and the type of treatments. Doppler Echocardiography is a simple non invasive valuable tool in diagnosing

diastolic dysfunction. In diabetics before they develop cardiac symptoms it has to be done routinely on every diabetic patients to assess the cardiac function.[19]

Exiara et. al in there study of 114 subjects stated that the prevalence of lv diastolic dysfunction in normotensive, asymptomatic and well controlled DM type2 patients is high and increases with age .A total of 63.2% patients had diastolic dysfunction.[20] Mishra *et al.* in their case control study of 71 subjects with type 2 DM found that asymptomatic diabetic patients have reduced LV systolic and diastolic function as compared with healthy subjects. LV systolic and diastolic abnormalities are correlated with the duration of diabetes and with diabetic microangiopathies, like retinopathy and neuropathy.[21] Soldatos *et al* in their case control study of 55 individuals with type -2 DM found that Diastolic dysfunction, present in a significant proportion of population with Type 2 DM.[22] Sacre *et al.* found that there was an independent association between global cardiac autonomic neuropathy (CAN) and left ventricular (LV) dysfunction in patients with type 2 DM.[23] Van Heerebeek *et al* in their study of 36 type -2 DM patients stated that, the cardiomyocyte resting tension is more important when LVEF is normal. Excessive diastolic left ventricular stiffness is an important contributor to heart failure in subjects with DM. Diabetes is presumed to increase stiffness through myocardial deposition of collagen and advanced glycation end products.[24] Masugata *et al* in their case control study of 77 normotensive patients found that, the cardiac diastolic dysfunction without LV systolic dysfunction in patients with well-controlled type 2 DM is related neither to hypertension nor LV hypertrophy, but rather to aging and the duration of type

2 DM.[25] Annonu *et al* in their case control study of 66 subjects found that there was an inverse correlation between the duration of diabetes and E/A ratio (r = -0.4, '*P*' <.005). E/A ratio < 1 was associated with a higher prevalence of retinopathy (49% versus 20%, 'p'0 =0.01) and abnormal blood pressure response to standing (29% versus 4%, '*P*' <.005). LV systolic and diastolic abnormalities are correlated with the duration of diabetes and with other diabetic microangiopathies, such as diabetic retinopathy and neuropathy.[26] Sohail *et al* in their study of 212 diabetic population found that 30.76% patients with type-2 DM had diastolic dysfunction. The LV diastolic dysfunction is much more prevalent in patients with type-2 diabetes mellitus and LV diastolic dysfunction is an early marker of diabetic cardiomyopathy.[27] Diamant *et al.* stated that early (E) acceleration peak, deceleration peak, peak filling rate, and E/A ratio, and all other indices of diastolic function, were significantly decreased in patients with recently diagnosed, well-controlled and uncomplicated type 2 diabetes compared with the controls ('*P*' < 0.02).[28] Bonito, *et al* stated that, an impairment of LV diastolic function occurs early in the natural history of type-2 DM, and is related to clinical evidence of microangiopathic complications.[29] Aaron *et al* in 1,760 diabetic patients found that, 411 (23%) patients had diastolic dysfunction and diabetic patients with diastolic dysfunction had a significantly higher mortality rate compared with those without diastolic dysfunction. An increase in the TDI velocity of the medial mitral annulus during passive filling (E/e') ratio in diabetic patients is associated with the subsequent development of HF.[30]

6.3 AIMS AND OBJECTIVES OF THE STUDY

1. To determine the pattern of echo findings and to correlate the findings in long standing diabetes mellitus.
2. To measure the relation of Left ventricular (LV) systolic and diastolic dysfunctions with age, duration of DM, Hba1c, obesity indices, Blood Pressure, Anthropometric parameter and microvascular complications of diabetes.

7. MATERIALS AND METHODS

A hospital based cross sectional observational study will be conducted with 300 patients for echocardiographic evaluation of diastolic dysfunction in type 2 diabetes mellitus.

7.1 Source of Data

A cross sectional observational study will be conducted at Dayanand Medical College and Hospital, Ludhiana which will include outpatients diagnosed cases of diabetes mellitus. It will also include written performa which will include epidemiological information such as age, sex, occupation, place.

7.2 METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA - All patients of type 2 diabetes mellitus of more than 7 year duration who clinically have no symptoms of cardiovascular involvement and ECG showing ischemic changes.

EXCLUSION CRITERIA – All patients with type 2 diabetes mellitus with other cardiac diseases like obstructive sleep apnea, valvular heart disease, congestive heart failure; cardiomyopathy, creatinine > 2mg/dl will be excluded from the study.

DURATION OF STUDY – 18 months.

SAMPLE SIZE - 300 cases.

METHODOLOGY – 300 outpatients and inpatients will be taken subjected thorough clinical examination supported by relevant investigations / the following investigations will be done:

- Blood Glucose on Admissions: FBS, PPBS,
- LFT, RFT, Including Electrolytes, Uric Acid
- Glycosylated Hemoglobin (HBA1C)

- Fasting Lipid Profile
- ECG
- Urine for Microalbuminemia
- Fundoscopy
- Chest X – Ray
- Echocardiography

OUTCOME: The outcome of our study will be to find out and correlates of Left ventricular (LV) systolic and diastolic dysfunction in long standing diabetics.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups will be done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test will be performed and exact test was used when the expected frequency is less than 5. A probability value (p value)less than 0.05 will be considered statistically significant. All statistical calculations will be done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

2D ECHOCARDIOGRAPHY

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached along with

LIST OF REFERENCES

1. Jain K, Palange AA, Kakrani AL, Dhanorkar AS. Left ventricular diastolic dysfunction in asymptomatic type 2 diabetes mellitus patients. Int J Res Med Sci. 2018;6:240-6
2. Chandalia M, Abate N, Garg A, Stray-Gundersen J, Grundy SM. Relationship between generalized and upper body obesity to insulin resistance in Asian Indian men. J Clin Endo Metab. 1999;84:2329-35.
3. Misra A, Vikram NK. Insulin resistance syndrome (metabolic syndrome) and Asian Indians. Current Science. 2002:1483-96.
4. Mohan V, Sharp PS, Cloke HR, Burrin JM, Schumer B, Kohner EM. Serum immunoreactive insulin responses to a glucose load in Asian Indian and European type 2 (non-insulin-dependent) diabetic patients and control subjects. Diabetologia. 1986;29:235-7.
5. Garcia MJ, McNamara PM, Gordon T, Kannell WB. Morbidity and mortality in diabetics in the Framingham population: sixteen-year follow-up study. Diabetes. 1974;23:105-11.
6. Weiner DA, Ryan TJ, McCabe CH, Luk S, Chaitman BR, Sheffield LT, Tristani F, Fisher LD. Significance of silent myocardial ischemia during exercise testing in patients with coronary artery disease. Am J Cardiol. 1987;59:725-9.
7. Airaksiran KEJ. Silent coronary artery disease in diabetics-A feature of autonomic neuropathy or accelerated atherosclerosis. Diabetologia. 2001;44:256-66.
8. From AM, Scott CG, Chen HH. Changes in diastolic dysfunction in diabetes mellitus over time. Am J Cardiol. 2009;103:1463-6.

9. Van Heerebeek L, Hamdani N, Handoko ML, Falcao-Pires I, Musters RJ, Kupreishvili K, et al. Diastolic stiffness of the failing diabetic heart. Circulation. 2008;117:43-51.

10. Oh JK, Seward JB, Tajik AJ. Assessment of diastolic dysfunction and diastolic heart failure. In: Oh JK, editor. The Echo Manual. 34th ed. New Delhi: Wolters Kluwer; 2006. p. 120-41.

11. Zarich SW, Nesto RW. Diabetic cardiomyopathy. Am Heart J. 1989;118:1000-12.

12. Francis GS. Diabetic cardiomyopathy: fact or fiction? Heart. 2001;85:247-8

13. Kazik A, Wilczek K, Poloński L. Management of diastolic heart failure. Cardiol J. 2010;17:558–65

14. From AM, Scott CG, Chen HH. Changes in diastolic dysfunction in diabetes mellitus over time. Am J Cardiol. 2009;103:1463–6.

15. Patil VC, Patil HV, Shah KB, Vasani JD, Shetty P. Diastolic dysfunction in asymptomatic type 2 diabetes mellitus with normal systolic function. J Cardiovasc Dis Res. 2011;2:213-22.

16. Wan SH, Vogel MW, Chen HH. Preclinical Diastolic Dysfunction. J Am Coll Cardiol. 2014;63:407–16.

17. Chaudhary AK, Aneja GK, Shukla S, Razi SM. Study on Diastolic Dysfunction in Newly Diagnosed Type 2 Diabetes Mellitus and its Correlation with Glycosylated Haemoglobin (HbA1C). J Clin Diagn Res. 2015;9:OC20-2.

18. Poulsen MK, Henriksen JE, Dahl J, Johansen A, Gerke O, Vach W, et al. Left ventricular diastolic function in type 2 diabetes mellitus: prevalence

and association with myocardial and vascular disease. Circ Cardiovasc Imaging. 2010;3:24-31

19. Patil MB, Burji NP. Echocardiographic evaluation of diastolic dysfunction in asymptomatic type 2 diabetes mellitus. J Assoc Physicians India. 2012;60:23.

20. Exiara T, Konstantis A, Papazoglou L, Kouroupi M, Kalpaka A, Mporgi L, et al. Left Ventricular Diastolic Dysfunction in Diabetes Mellitus Type 2: Pp.17.147. Journal of Hypertension. 2010;28:e294.

21. Mishra TK, Rath PK, Mohanty NK, Mishra SK. Left ventricular systolic and diastolic dysfunction and their relationship with microvascular complications in normotensive, asymptomatic patients with type 2 diabetes mellitus. Indian Heart J. 2008;60:548–53

22. Soldatos G, Jandeleit-Dahm K, Thomson H, Formosa M, D'orsa K, Calkin AC, et al. Large artery biomechanics and diastolic dysfunctionin patients with Type 2 diabetes. Diabet Med. 2011;28:54–60

23. Sacre JW, Franjic B, Jellis CL, Jenkins C, Coombes JS, Marwick TH. Association of cardiac autonomic neuropathy with subclinical myocardial dysfunction in type 2 diabetes. JACC Cardiovasc Imaging. 2010;3:1207–15.

24. van Heerebeek L, Hamdani N, Handoko ML, Falcao-Pires I, Musters RJ, Kupreishvili K, et al. Diastolic stiffness of the failing diabetic heart: Importance of fibrosis, advanced glycation end products, and myocyte resting tension. Circulation. 2008;1:43–51.

25. Masugata H, Senda S, Goda F, Yoshihara Y, Yoshikawa K, Fujita N, et al. Left ventricular diastolic dysfunction in normotensive diabetic patients in various age strata. Diabetes Res Clin Pract. 2008;79:91–6.

26. Annonu AK, Fattah AA, Mokhtar MS, Ghareeb S, Elhendy A. Left ventricular systolic and diastolic functional abnormalities in asymptomatic patients with non-insulin-dependent diabetes mellitus. J Am Soc Echocardiogr. 2001;14:885–91.

27. Ashraf SM, Basir F. Association of hypertension and diastolic dysfunction with type-2 diabetes mellitus. Pak J Med Sci. 2007;23:344–8.

28. Diamant M, Lamb HJ, Groeneveld Y, Endert EL, Smit JW, Bax JJ, et al. Diastolic dysfunction is associated with altered myocardial metabolism inasymptomatic normotensive patients with well-controlled type 2 diabetes mellitus. J Am Coll Cardiol. 2003;42:328–35.

29. Bonito PD, Cuomo S, Moio N, Sibilio G, Sabatini D, Quattrin S, et al. Diastolic dysfunction in patients with non-insulin-dependent diabetes mellitus of short duration. Diabet Med. 1996;13:321–4.

30. From AM, Scott CG, Chen HH. The development of heart failure in patients with diabetes mellitus and pre-clinical diastolic dysfunction. J Am Coll Cardiol. 2010;55:300-5

PROFORMA

SR NO. -

NAME - MRD. NO-

AGE - SEX -

OCCUPATION - RELIGION-

DATE OF ADMISSION - DATE OF DISCHARGE

EDUCATION - PHONE NO-

ADDRESS-

PRESENTING COMPLAINTS (WITH DURATION)-

DYSPNOEA
CHEST PAIN
FATIGUE
EXERCISE AND PHYSICAL ACTIVITY
PALPITATION
SYNCOPE
WEIGHT LOSS
SWELLING LEGS
DISORDERED BREATHING AT NIGHT OBSTRUCTIVE SLEEP APNOEA
RECENT OR FREQUENT PRIOR HOSPITALISATION
OTHERS

Signature of candidate **Signature of supervisor**

PAST HISTORY-

		DURATION
HYPERTENSION	Y/N	
RENAL FAILURE	Y/N	
CARDIAC DISEASE	Y/N	
PULMONARY DISEASE	Y/N	
THYROID DISORDER	Y/N	
TUBERCULOSIS	Y/N	
BRONCHIAL ASTHMA	Y/N	
OTHER	Y/N	

PERSONAL HISTORY -

ALCOHOL CONSUMPTION

SMOKING

ANY OTHER ADDICTION OR ILLICIT DRUG ABUSE (IF ANY)

LIFE STYLE (SEDENTARY/ MODERATE ACTIVITY/ HEAVY PHYSICAL ACTIVITY)

GENERAL PHYSICAL EXAMINATION-

PULSE -

RESP. RATE -

TEMPERATURE -

BLOOD PRESSURE - 1ST READING _____

2ND READING_____

3RD READING_____

HEIGHT -

WEIGHT –

WAIST CIRCUMFERENCE -

PALLOR
CYNOSIS
EDEMA
CLUBBING
JUGULAR VENOUS PRESSURE
ICTERUS

Signature of candidate **Signature of supervisor**

BODY MASS INDEX (KG/M2)-

WAIST HIP RATIO-

OTHER FINDINGS-

SYSTEMIC EXAMINATION-

CVS

APEX

PARASTERNAL HEAVE

HEART SOUNDS

S3 GALLOP

MURMUR

RESPITATORY

AIR ENTRY

BREATH SOUNDS

RHONCHI/CREPTS

PER ABDOMEN

CNS

OLD TREATMENT RECORD

MEDICATIONS

WHEATER COMPLAINT TO TREATMENT YES /NO

IF NO SINCE HOW MANY DAYS AND REASON

INVESTIGATIONS DATE

HB

TLC

DLC

PLATELET

RBC

UREA

CREATININE

SODIUM

Signature of candidate **Signature of supervisor**

POTASSIUM

CHLORIDE

BLOOD SUGAR: FBS, PPBS

SGOT

SGPT

GLYCOSYLETED HEMOGLOBIN (HBA1C)

CHEST X-RAY

ECG

BIOMARKER OF MYOCARDIAL INJURY

BNP

FUNDUS EXAMINATION:

ECHOCARDIOGRAPHY

MEASUREMENTS		**NORMAL VALUES**
AORTIC ROOT :	_____ mm	(27-30mm)
LEFT ATRIUM :	_____mm	(20-40mm)
RIGHT ATRIUM:	_____mm	(21-25mm)
RVID (D) :	_____mm	(19-30mm)
IVST (D) :	_____mm	(7-11mm)
IVST (S):	_____mm	(7-11mm)
LVID(D):	_____mm	(42-58mm)
LVID(S):	_____mm	(25-39mm)
LVPW(D):	_____mm	(7-11mm)
LVPW(S):	_____mm	(7-11mm)

LV FUNCTION

EJECTION FRACTION:	(52-72%)
FRACTIONAL SHORTENING:	(26-36%)
END DIASTOLIC VOLUME:	(62-150ml)
END SYSTOLIC VOLUME:	(21-61ml)

Signature of candidate **Signature of supervisor**

POTASSIUM

CHLORIDE

BLOOD SUGAR: FBS, PPBS

SGOT

SGPT

GLYCOSYLETED HEMOGLOBIN (HBA1C)

CHEST X-RAY

ECG

BIOMARKER OF MYOCARDIAL INJURY

BNP

FUNDUS EXAMINATION:

ECHOCARDIOGRAPHY

MEASUREMENTS		**NORMAL VALUES**
AORTIC ROOT :	_____ mm	(27-30mm)
LEFT ATRIUM :	_____mm	(20-40mm)
RIGHT ATRIUM:	_____mm	(21-25mm)
RVID (D) :	_____mm	(19-30mm)
IVST (D) :	_____mm	(7-11mm)
IVST (S):	_____mm	(7-11mm)
LVID(D):	_____mm	(42-58mm)
LVID(S):	_____mm	(25-39mm)
LVPW(D):	_____mm	(7-11mm)
LVPW(S):	_____mm	(7-11mm)

LV FUNCTION

EJECTION FRACTION:	(52-72%)
FRACTIONAL SHORTENING:	(26-36%)
END DIASTOLIC VOLUME:	(62-150ml)
END SYSTOLIC VOLUME:	(21-61ml)

Signature of candidate **Signature of supervisor**

Mitral valve : E/A= , E/E'=

Aortic valve :

Tricuspid valve :

Pulmonary valve :

Pericardium :

Wall motion abnormalities:

Cardiac chambers :

DOPPLER EVALUATION

VELOCITY (GRADIENT)	(GRADE)
MV:	MR:
AV:	AR:
TV:	TR:
PV:	PR:

IMPRESSION:

Signature of candidate **Signature of supervisor**

CERTIFICATE OF DEPARTMENTAL CLEARANCE

This is to certify that the plan of thesis entitled "**ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS**" has been discussed in the Department of Medicine, Dayanand Medical College and Hospital, Ludhiana and approved by whole of the faculty of the Department. The plan writing is satisfactory.

Supervisor

Dr. Dinesh Gupta
Professor & Head
Department of Medicine
DMCH, Ludhiana

Co-Supervisor

Dr. Parminder Singh
Professor & Head
Department of Endocrinology
DMCH, Ludhiana

Dr. Gurpreet S Wander
Professor & Head
Department of Cardiology
DMCH, Ludhiana

Head of Department

Dr. Dinesh Gupta
Professor & Head
Department of Medicine
DMCH, Ludhiana

DAYANAND MEDICAL COLLEGE & HOSPITAL
LUDHIANA

Ref. No: DMCH/

Dated: 17/12/2018

TO WHOM IT MAY CONCERN

Certified that the study entitled "**ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS**" involves only such investigations and / or treatment, which are relevant in the management of patients and has no extra cost implications to the patient.

Name of candidate:	Dr. Kapil Dev
Supervisor:	Dr. Dinesh Gupta
Co-Supervisor(s):	Dr. Parminder Singh
	Dr. Gurpreet S Wander

Signature of candidate

Signature of Supervisor

DAYANAND MEDICAL COLLEGE & HOSPITAL,
LUDHIANA

Ref. No. DMCH/

Dated : 17/12/2018

TO WHOM IT MAY CONCERN

I shall carry out the study "**ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS**" meticulously and shall maintain the records for 5 years after the submission of thesis and present them to any competent authority as and when required. The following documents will be preserved:

1. List of enrolled patients with identification details
2. Consent forms of all the enrolled patients
3. Proforma of each patient with verifiable details, individually signed by supervisor.

Dr. Kapil Dev
P.G. Resident
Dept. of Medicine
DMC & Hospital, Ludhiana

CERTIFICATE

We hereby certify that the informed patient consent form and its translation and back translation to Hindi and Punjabi are accurate to the best of our knowledge and satisfaction.

Supervisor

Dr. Dinesh Gupta
Professor & Head
Department of Medicine
DMCH, Ludhiana

Co-Supervisor

Dr. Parminder Singh
Professor & Head
Department of Endocrinology
DMCH, Ludhiana

Dr. Gurpreet S Wander
Professor & Head
Department of Cardiology
DMCH, Ludhiana

Dr. Kapil Dev
P.G. Resident
Dept. of Medicine
DMC & Hospital, Ludhiana

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o.....

am willing to participate in the study **"ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

.....
Signature of the Witness

Name:

.....
Signature of the patient

Signature of Candidate

Signature of Supervisor

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य "**ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS**" में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"ECHOCARDIOGRAPHIC ASSESSMENT AND CORRELATES AMONG LONG STANDING TYPE 2 DIABETICS" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ